The Dock and Harbour Authority

No. 291. Vol. XXV. Edited by BRYSSON CUNNINGHAM, D.Sc. B.E., F.R.S.E., M.Inst.C.E. January, 1945

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Editorial Comments

New Year.

To all readers at home and abroad we send greetings, and good wishes both for themselves and the port or maritime organisations with which they are associated. It is to be hoped that the coming twelve months will bring a restoration of ordered enterprise and a revival of prosperity, not merely to British and Allied Continental ports, but to all the various oppressed nationalities which, for the past five years, have been experiencing the terrible dislocations and privations of war. We cannot yet speak with any assured degree of confidence, for the conflict is not yet over, and, indeed, at the moment of writing, on the eve of Christmas, it is in what press correspondents describe as a "state of flux." At any time the situation may take a new and unexpected turn, concerning which and future events it would be extremely unsafe to prophesy.

Looking back, however, on the past year, it will be generally felt that there is without question a distinct improvement in the situation, though the Prime Minister has warned the country that there is still a toilsome road to travel before the end is achieved.

The record of 1944 has been a continuation of the dreary toll of devastation among Continental ports. Ruin has been widespread, both by actual fighting and by bombing. Cherbourg, Le Havre and the other Channel ports, Marseilles, Rotterdam and Toulon, have all undergone severe damage, some of which, however, has been made good. Antwerp, alone, in the track of war, seems to have escaped comparatively lightly, and fortunately, has remained in serviceable condition.

If matters continue to progress satisfactorily many questions of serious import to port authorities will arise to be dealt with in the near future. Not the least important of these is a settlement of policy in regard to the future administration of British ports. The subject has been frequently commented upon in these columns, but there is a great deal more which can be said, and we would urge our readers to give expression to their views, while the matter is still under consideration. It is only by an adequate presentation of all the various aspects of the problem that a wise and reliable judgment can be formed. The Dock and Harbour Authorities Association has, so far, given no public pronouncement on its attitude. It need hardly be said that this is awaited with no little interest by many of our readers. We understand that a special meeting of the Association is to be held early in February to deal with the matter, and to consider certain recommendations which are to be submitted by the committee appointed for the purpose.

The Port of Cork.

Nearly ten years have passed since, in August, 1935, the Port of Cork received detailed notice in this Journal; the appearance of Mr. Kane's article in the present issue is, therefore, timely and appropriate, as representative of the current maritime activities of the Dominion of Eire. It is true that the exigencies of the censorship have regrettably interfered with the publication of many interesting features of recent developments at the port, but this must be looked upon as inevitable, and we are confident that the survey of its past history cannot fail to be instructive and illuminating.

The County of Cork, in the Province of Munster, has the distinction of being the largest in area, with a county borough almost the largest in population, in Eire, being surpassed in the latter respect only by the capital, Dublin. The city has a long and varied historical record, dating back, at least, to the days of Henry II and Richard de Clare, surnamed Strongbow, whom he made Seneschal of Ireland in the latter half of the 12th century. At one time, prior to the advent of Strongbow, Cork was a kingdom of its own, under the rule of the McCarthys. But we must leave our readers to trace the fortunes of the city and port in the article to which reference has been made above.

Cork possesses an excellent harbour on the river Lee, situated some 15 miles from the open sea, with deep-water quays and jetties, affording accommodation for vessels up to 30-ft. draught at all stages of the tide. As a port of call, its annexe, Cobhe (formerly Queenstown) is perhaps better known through the many visits of transatlantic liners of the largest size on their outward and homeward journeys. It is to be hoped that the days are not far distant when these visits will be renewed and fresh importance gained by the joint leading port and harbour in the South of Ireland.

British Export Trade.

In the early part of December, attention was called in both Houses of Parliament to the unfortunate and regrettable position of British Export Trade, as revealed in statistics which had just been issued by the Board of Trade. At the outset of this Comment we pause a moment to anticipate a possible criticism concerning our alleged intrusion into a field not strictly, nor patently, covered by the title of this Journal, by remarking that the prosperity of British ports being obviously bound up with the develop-

Editorial Comments—continued

ment of overseas commerce, it must inevitably be a matter of very serious concern to British port authorities that the war has reduced the commercial exports of the nation to such low ebb. To resume, Lord Wimborne, during the debate in the House of Lords, pointed out out that it the war were to end immediately, the country would find itself with only a quarter of its pre-war export trade and with its merchant shipping fleet reduced by nearly a third. Going to the official source of his information in order to emphasise the critical nature of the situation, we venture to quote the following extract from the *Board of Trade Accounts relating to the Export Trade of the United Kingdom* (H.M. Stationery Office. Price: one shilling).

"Eliminating the effect of price changes the resultant volume figures show that exports in 1939 were 6 per cent. less than in 1938, this fall resulting entirely from the effect of the war on the trade of the last four months. In 1940 and 1941, exports were only 73 per cent. and 56 per cent. respectively, of those in 1938. These included export of munitions by Government Departments, which were large in 1941. Excluding munitions, exports in 1942 and 1943 were 36 per cent. and 29 per cent. respectively, of the 1938 figure. Exports in 1938 were at a rather low level, those in 1937 being 13 per cent. higher; if the average of the two years 1937 and 1938 were taken as a base, the volume figures for 1939, 1940 and 1941 would be reduced to 89, 68 and 53 per cent. respectively, and those for 1942 and 1943 to 34 and 27 per cent. Thus, by 1943 nearly three-quarters of our export trade had been sacrificed to the needs of the war effort, and, as indicated above, a considerable proportion of the exports recorded are not truly commercial."

No one in the course of the debates in both houses ventured to contest the gravity of the position; almost every speaker voiced the conviction that something had to be done to remedy matters. On account of the heavy burden of taxation and the appalling war indebtedness, it was stated that exports would need to be raised by at least 50 per cent. above the level of 1938, if the country is to be saved from bankruptcy and reasonable provision made for the rather grandiose schemes of social betterment to which it has been committed in principle.

The disquieting feature about the debate was that no one was able to give any clear and definite advice as to how this result was to be achieved. Nearly everybody called for Government action, or what was called a "lead." In reply, Mr. Lyttleton, Minister of Production said, rather vaguely: "I am sure it can be done. It will no doubt require some time and it will require great drive and push" (*Daily Telegraph*, December 8th). He did not explain otherwise than by a general reference to "industry," who was to do the drive and push. With encouragement, industrialists and manufacturers would, no doubt, be willing to make a whole-hearted attempt, but will they receive the essential help and support from their workers, who will be called upon, not only to provide the goods, but to provide them *at a lower cost* than competitive nationalities, who are eager to capture the markets hitherto considered the special preserves of Great Britain? Increasing wages, even though justified as a set-off against higher cost of living, will not help matters, and experience has sadly shown in the coal mining industry that increase in pay may lead to decrease in output.

The problem concerns the craftsman, the artificer and the ordinary labourer, no less than the manufacturer, the merchant and the shipowner. Will the British working man pay heed to the admonition? Will he forego hasty, truculent strikes and demands for higher pay than the industry can afford? This, it seems to us, is the essential crux of the matter. If Labour persists in an attitude of unreasoning hostility to obvious economic facts, then financial disaster lies ahead.

Port authorities will naturally do all that lies in their power to facilitate and promote trade, but they cannot create it. It must come in the last resort, from the spirit and determination of the workers.

Port Labour Rates.

Amplifying the foregoing comment with a concrete instance lying within the field of port operation, it may be pointed out that the attitude of port labour towards the cost of transport has unquestionably an important bearing on the economic position. The war has seen a phenomenal and startling increase in rates of pay to dockers and others engaged in handling cargoes. Under the existing arrangement which, it is freely assumed, will be continued in force after the war, a minimum wage of 11s. per day is payable whether there is work available for the men or not. For normal times such payment is undoubtedly—some will even think, exceptionally—liberal. But it is by no means the limit of a docker's remuneration. We quote as follows from a shipping contemporary:

"At the moment dock labour costs are substantial and dockers' earnings, where considerable overtime has been worked, are relatively very high. On the Tyne, for instance, returns of dockers' weekly earnings show that sums of £12 and £14 are not uncommon, and where jobs involve a good deal of week-end work, men may sometimes draw £16 to £18. Recently I saw figures where one man's earnings had topped £20 for the week."

Now, as with other expenses of transport, the cost of cargo handling is inevitably reflected in the market prices of goods and commodities and it is obvious that these cannot be kept within competitive bounds if extravagantly high rates are paid for dock labour. Here, as in other cases, the success of the campaign for exports lies very largely in the attitude and demands of the workers.

Port Improvement Works.

As will be seen from the report of the recent address by the chairman to members of the Mersey Docks and Harbour Board, an important programme of port alteration and improvement works at Liverpool is to be held up pending the execution of other public works, considered to be entitled to precedence in view of the scarcity of labour. Although the postponement is greatly to be regretted, it will be felt that the needs of housing and certain essential public services have a claim to priority, which, in the circumstances, no one will be inclined to begrudge. Having regard, however, to the importance of adequate and up-to-date port facilities for dealing with seaborne trade, it is to be hoped that the delay will be of short duration, and that permission to proceed will be forthcoming at an early date, not only for the works on Merseyside, but also for other development works elsewhere coming in the same category, which have been outlined in previous issues of this Journal. The stress of foreign competition renders it essential that port authorities in this country should not be hampered in their designs for providing the requisite facilities to meet the operational demands likely to be made on them.

Humanised Transport.

In his Inaugural Address as President of the Institute of Transport for the coming Session, Mr. Robert Kelso dealt with an aspect of transport work which is not often, nor very prominently, given the publicity it deserves. Machines are devised and movements scheduled with a certain degree of confidence that they will fulfil the intentions of their originators. One important factor, however, is incalculable—the human element—and yet on this depends the success or failure of the most thoroughly worked-out and elaborately-designed scheme. How often has it had to be tragically recorded that an accident, involving perhaps the death of hundreds of people, has been due to the failure at the critical moment of the human factor! For an appropriate illustration, we need go no further back than the great disaster in April last at the Port of Bombay.

It was not, however, so much this tragic side of human miscalculation to which Mr. Kelso alluded, as to the economic influence of human effort in transport enterprise. As a shipowner he drew his examples from the world of shipping, which naturally includes the domain of ports. He made a number of pertinent remarks on the subject, some of which will be found on a later page. We will leave his observations to speak for themselves, simply calling the attention of our readers to the three points in his final summary which at the present juncture are deserving of very careful consideration.

IMPORTANT NOTE:

To avoid delay, readers are reminded that all communications on purely editorial matters should be addressed to The Editor, 43, Carlisle Road, Eastbourne. Business correspondence should be sent to the Publishing Office, 19, Harcourt Street, London, W.1.

The Port of Cork

Origin and Development of Eire's Chief Trans-Atlantic Harbour

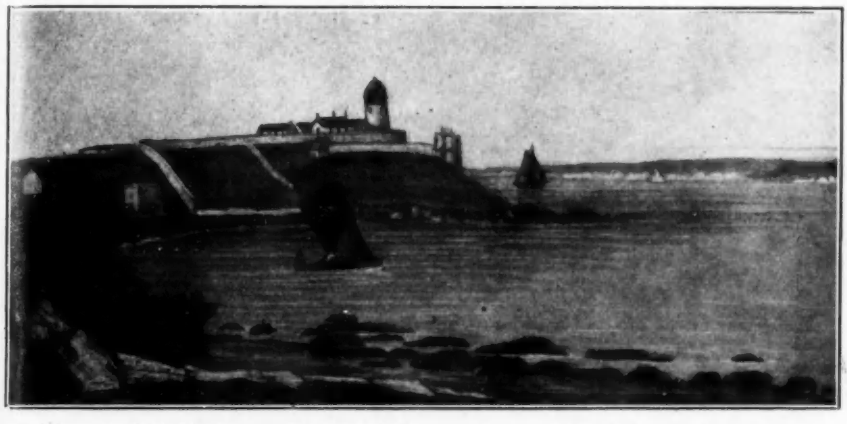
By AL KANE.

Ancient History

CORK, which before the war was the chief port of call in Eire for transatlantic liners, has a maritime history which dates back to pre-Christian times.

It is recorded that in the fourth century an Irish monarch, Crimthan, who was also styled King of Albany, fitted out, at Cork, a formidable fleet with which he invaded Gaul and Britain. Defeating the Romans, he ravaged their settlements, and returned to Ireland laden with spoil.

Although Ptolemy mentions the existence of a settlement at Cork in the second century, yet it did not assume any importance until the seventh century, when St. Finbarr founded his monastic school there, and the city, in due course, grew up around it.



A View of Cork Harbour and the Lighthouse, from a Sketch by H. Morgan (1849). Courtesy, National Library, Dublin.

Of Cork's maritime activities at that time we have very scanty and unreliable records.

In the ninth century the history of the port may be said to have begun, when Cork was invaded by Norsemen, who built a strong fortress there. Several times during the following centuries Cork was burnt down by marauding chieftains and invaders.

It was attacked by the Danes in 851, and again in 917, when a considerable number of them settled there.

In 937 the Norsemen and Danes of Cork were attacked by Cellachain of Cashel, who defeated them and destroyed the town. The invaders, however, returned, attracted, no doubt, by its important maritime situation, and rebuilt their settlements there.

It was by these Scandinavian invaders that Cork's maritime commerce was founded. They traded in such commodities as cloth, corn, honey, wine, furs, hides and fish. Their trade was mainly with English ports, but their ships also sailed to Scandinavia, Russia, Normandy, the Hebrides, the Orkney Islands and Iceland.

Mediæval Period

During the ensuing centuries there is very little mention of Cork's maritime activities. In the thirteenth century, during the reign of Henry III, the prisage on wine, which had formerly been payable to the King, was granted to the citizens of Cork. At one time this prisage was payable in kind, but was later changed to a levy of 2s. per tun.

In 1275 export duties on goods leaving Cork for overseas ports were imposed as follows: ½ mark (6s. 8d.) on each sack of wool; ½ mark on each 300 woolfills; 1 mark on each last of hides. The figures show that the amount of revenue by this imposition for the following three years was £731 12s. 6d.

During this period we find that Cork ranked second among the four principal ports of Ireland.

In 1305 the "Great New Custom," which imposed a levy on cloth and wax, and also 3d. in the £ *ad valorem* on all other commodities, was the subject of a dispute when a merchant of Aquitaine, arriving with a cargo of wines, claimed that the new levy released him from the obligation of paying prisage.

The Mayor, however, insisted on the payment of both levy and prisage, and the dispute resulted in a law suit, the result of which has not been recorded.

During the thirteenth century Cork did a considerable trade in wines, importing them from Gascony, Bayonne and Bordeaux. There was also a considerable trade in the re-export of these wines, for which several Cork merchants held contracts to supply the King's army in various parts of Scotland and Wales.

Other exports from Cork at that time were oats, wheat, salted pork, oatmeal, fish and malt. These provisions were, like the wine, shipped mainly for the King's army and were consigned to such ports as Bristol, Carlisle, Southampton and Pembroke.

In 1294 the export of hides, wool and woolfills to France and the French colonies was prohibited.

In 1326 Cork was created a Staple port. This greatly increased the commerce there, merchants from other cities, such as Galway, being obliged to come there with the goods they wished to export.

In 1569 tunnage is recorded to have been, for the first time, imposed at Cork. The act decreed that certain ports—Dublin, Cork, Waterford and Limerick—were to be the only places through which wine could be imported into Ireland. It also fixed the duties at different rates on different wines, the duty on Spanish wine being 40s. per tun and on French wine 26s. 8d.

The turbulence of the fifteenth and sixteenth centuries resulted in a decline of Cork's maritime trade, to such an extent that Cork merchants were not adverse to doing business even with pirates. For example, in 1548 a number of merchants solicited permission from the Lord Deputy to be allowed to do business with two pirates who had arrived in Cork, and who had a cargo of wines, figs and sugar to dispose of. It is interesting to read that the request permission was granted.

Three years later it is recorded that an Irish vessel, owned by three Cork merchants, and carrying a cargo of skins and cloth, was unsuccessfully attacked by pirates.

In the sixteenth century the first mention of the export from Cork of linen and salted beef is recorded. The mention of the export of linen is interesting, as it effectively refutes the statement, often made, that the manufacture of linen was unknown in Ireland until the seventeenth century.

Although the direct trade between Cork and Spain was small during the latter half of the sixteenth century, yet in 1597 a law was passed prohibiting all intercourse with Spain owing to the imminent danger of a Spanish invasion.

Following the Elizabethan wars in Ireland, trade and commerce fell to a very low ebb, with conditions so appalling that "the lowing of a cow, or the voice of a ploughman could scarcely be heard from Duncaoin to Cashel in Munster."

Following the accession of James I, trade revived in Ireland,

Port of Cork—continued

the value of her trade at her five principal ports during the years 1610-11 being as follows:

Dublin	£80,000
Waterford	£30,000
Cork	£20,000
Drogheda	£20,000
Limerick	£10,000

Business relations with Spain, Portugal and Italy were also resumed during this period.

The menace of pirates, however, hindered Irish commerce seriously until Wentworth drove them from our seas during the years 1632 to 1634. Following this, Irish commerce increased, and it was at this period that the export of cattle, butter and provisions became an established branch of Irish trade.

After the Cromwellian war in Ireland, the new settlers monopolised the trade and industry of Cork, and the native Irish were forbidden to take any part in it. During that period the exports from Cork included beef, butter, wheat and cheese, destined for such places as the West Indies, Virginia, Barbadoes, Madeira and the Leeward Islands. Business connections were also made with Ostend, Nante, St. Malo, Cadiz, St. Martin's and Rochelle, and Cork became a recognised port of call for transatlantic shipping.

In 1698 it is recorded that Alderman Hoare was appointed Agent for the Commissioners of Victualling. His duty was to supply provisions for His Majesty's ships on the transatlantic and other routes. The appointment indicates that Cork had been recognised as an important transatlantic station.

The eighteenth century saw an era of prosperity for the port of Cork. Many new markets were secured, and Cork consignments found their way to such ports as Philadelphia, St. Kitt's, St. Christopher's, Jamaica, Montserrat, St. Eustatia, Nevis, Tortola, the West Indies, Amsterdam, Malga, Rotterdam, Lisburn, Seville Le Havre and Hamburg. In the middle of that century Cork was described as having an export trade in beef and butter " greater than those of any town in the King's dominions."

The Herring Industry

Another important export trade which developed in the second half of the eighteenth century was that of cured herrings. Owing to the skill displayed by the Cork merchants in the salting of beef and butter, it became a practice to send fish to Cork to be pickled. And for this purpose herrings were despatched to Cork from all the principal fishing centres in Ireland. A considerable amount of Scotch herrings were also bought by the Cork merchants for pickling and export.

In 1741 the number of barrels of salt herrings exported from Cork was 873; by 1766 this had risen to 12,000 yearly, while in 1775 one Cork merchant handled close on 42,000 barrels of salt herrings. This trade was mainly with America and the West Indies.

In the early part of the eighteenth century the number of vessels calling at Cork was approximately 700, with a tonnage of 36,576 tons. This indicated that Cork had approximately 1/5th of the shipping trade of the entire country.

During that century shipping at Cork reached such dimensions that the need for adequate harbour facilities became apparent. In 1703 a resolution was passed by the Corporation requesting Parliament for an Act authorising the cleansing and improving of the harbour and river bed out of public funds. A few months later such an Act was passed, but very little was done to improve the port.

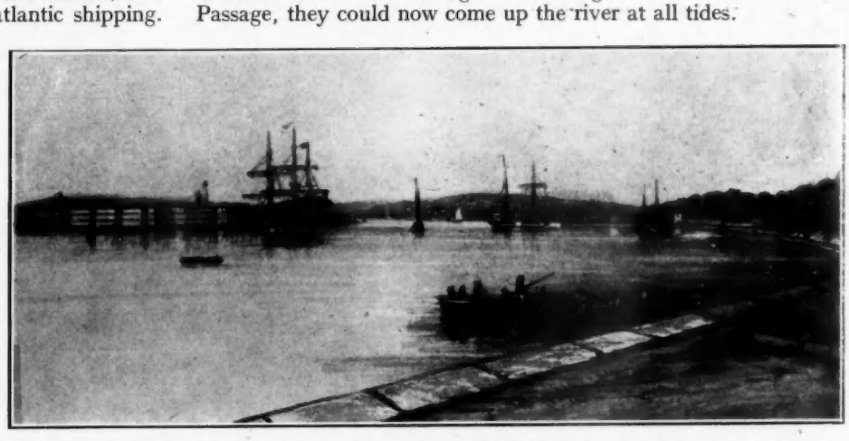
Tweny-six years later the cities of Cork, Galway, Waterford and Limerick petitioned Parliament for authority to set up a body to take charge of their respective harbours, erect ballast offices, etc. This petition was granted, and twenty-four commissioners, including the Mayor and Sheriff were appointed conservators at each of the ports.

The new scheme included the payment of tonnage dues at the rate of 1d. per ton for all Irish and British vessels, and 1½d. per ton for all foreign vessels entering Cork, those in the King's service being, however, free. It also included the building of a ballast office.

Despite these two acts, however, little was done to improve the harbour until the middle of the eighteenth century, when it was proposed to Parliament that the River Lee should be dredged, and made navigable as far as Macroon. For some years this proposal remain unanswered, until finally a grant of £4,000 was made for the work, which was to comprise the deepening and improvement of the channel from the Custom House quay to Blackrock.

It was found that the grant was insufficient, and further sums of £2,500, £3,000, and £2,000 were voted for the work. These still not proving sufficient, a committee was set up to enquire into the matter.

Their report indicated that considerable improvements had been made and they recommended a further grant of £6,000, which was, however, reduced to £2,000 by Parliament and passed. During the following years several other grants were made, all of which resulted in such improvements that, whereas formerly vessels of 100 tons had to discharge their cargoes either at Cobh or Passage, they could now come up the river at all tides.



A View of Haulbowline and White Point, from Columbine Quay, Cobh, from a Sketch by H. Morgan (1849). Courtesy National Library, Dublin.

Despite repeated requests, however, Parliament refused to vote any further sums for its improvement, and in a few years the work begun was abandoned, and the harbour soon returned to its former state. By 1810 vessels were again discharging at Cobh and Passage, being unable to go up the river.

Port Authority Constituted

Then in 1820 another Act was passed constituting the Cork Harbour Commissioners, and giving them power to carry out the necessary work for the improvement of the harbour and river. It was not, however, until 1826 that work was begun, when a dredger was purchased, and excavating begun between Queen's Quay and Oliver Point. This work occupied six years, during which time 182,877 tons of mud and gravel were removed from the river bed.

In 1840 work was begun on the flats at the south end of the Murtagh Bank. When the dredging there was finished, there was a navigable channel over 300-ft. wide, and with a depth of 10-ft. of water at low tide, where there had formerly being only 4-ft.

In 1855 the foundation of the old quays, which were merely lime and mortar walls, were reinforced with sheet piling in order to allow dredging to 8-ft. below low water springs.

In 1870 jetties, capable of accommodating vessels of 18-ft. draught were constructed on the south side of the Lee and further dredging was carried out, resulting in a channel 250-ft. wide and 14-ft. deep leading to Cork. This work was finished in 1883.

Thirteen years later a further ambitious dredging scheme was begun from Tivoli to Cork by the Cork Harbour Commissioners. The result was that the channel at Tivoli was increased to 280-ft., and was gradually extended until at Cork there was a channel 350-ft. wide and 16-ft. deep at low water. This work took five

Port of Cork—continued

years to complete and greatly improved the port by increasing the scour.

In 1903 the Custom House Quays were rebuilt, and the deep water berthage doubled. During 1912-13 the accommodation for transatlantic liners was increased by dredging at the western side. In 1928 the timber structure known as the South Jetties, was replaced by a modern concrete jetty, 1,200-ft. long and with 30-ft. of water at L.W.S. along its entire length.

Present-Day Accommodation.

The result of all this work is that the Port of Cork is one of the finest in these Islands. The Lower Harbour can now accommodate the largest vessels afloat. It is 350 miles nearer to New York than Southampton, and in pre-war days was one of the principal ports of call for American liners.

The sea, which stretches from Poor Head to Cork Head, a bay 5 miles wide, is so sheltered that liners can usually embark mails and passengers without entering the harbour. Five liners have been known to drop anchor there in a single day.

The Lower Harbour may be entered by two channels—the eastern and western, with 38 and 42-ft. of water respectively at L.W.S. After passing the Turbot Bank there is an anchorage 6½ miles long, an area of 4,000 by 2,000-ft. being reserved for transatlantic liners.

In many cases the accommodation at the various quays have been doubled within recent years. The quayage at present is:

	Length ft.	Depth ft.
North Deep Water Quay and Penrose Quay ...	1,740	24
Anderson's Quay and North Custom Quay ...	1,270	22
South Deep Water Quay	660	26
South Jetties	1,153	30
Albert Quay	1,010	24
South Custom House Quay and Lapps Quay...	950	20
Penrose Quay and St. Patrick's Quay ...	1,680	16
Other Quays	5,300	5 to 7

The above depths are at L.W.S.

For the speedy handling of cargoes, sheer legs, with a lifting capacity of 40 tons are available, while there are also a number of modern electric cranes with 25-ton capacities, and also a number of smaller ones. The railway connections run alongside all the principal quays. The warehousing at the Port of Cork is conducted by the Cork Bonded Warehouses, Ltd., Custom House Warehouse, which provides considerable accommodation for both dutiable and free goods.

Leith Dock Commission

Election of Officers

Leith Dock Commissioners, at a meeting on 24th November, re-elected Mr. Hugh Rose, C.A., as their chairman for another year. The appointment was made on the motion of Sir Gilbert Archer, seconded by Mr. C. Campbell, both of whom spoke of Mr. Rose's success in the chair.

Mr. Rose, in expressing his thanks for his re-election, said that he was glad that all the retiring members had been returned to office. The revenue from the financial year, which ended on May 15th last, had shown a substantial increase, and although during the last few months there had been a slight decrease in the amount of traffic, there were indications of an improvement in the future.

He mentioned that the first-aid post which was provided by the Commissioners and operated by the City Civil Defence had now closed down, but he understood that during the year it had been operative it had been of great service to the workmen in the docks who had received minor injuries in the course of their work. Under these circumstances he thought that an effort should be made to continue this post as a permanent part of the welfare arrangements for dock workers.

Mr. Rose then intimated that, owing to pressure of other important business, it was his intention to retire from the Commission before this year of office expired.

Conveners of the committee were re-appointed.

New Zealand Harbours

Problems and Proposals at Greymouth and Westport

Problems which have arisen in connection with the persistent shoaling of the entrances to the Ports of Greymouth and Westport on the West Coast of South Island, New Zealand, have lately been under discussion by a local (Westland) deputation with the Hon. Jas. O'Brien, Minister of Marine. After a period of comparative stability, the bar at the entrance of the Grey River has undergone further deterioration, resulting in a decrease in depth of water of 2-ft. As a result, large vessels have to operate with restricted cargoes Similar trouble has been experienced at the mouth of the Buller River in which Westport is located, 90 miles north of Greymouth. It has been suggested that the only solution of the difficulty is the formation of outer deep water harbours beyond the present range of silting.

While the Minister was not able to promise any immediate steps by the Government in the construction of all-weather deep-sea harbours, he said that he would have investigations continued and that in the meantime the Greymouth and Westport harbours would be made as workable as possible. The Government would also take soundings at one of the proposed deep-sea harbour sites, Point Elizabeth.

The Position of Greymouth

The leader of the deputation, Mr. W. D. Taylor, said there was no port in the Dominion so important as Greymouth. It was obvious that a bar harbour was most unsatisfactory for the great volume of trade and the only remedy was a deep-sea harbour. He referred to the Auckland City Council's representations for an investigation of the deep-sea harbour proposal to remedy the difficulty in getting supplies of coal away regularly.

The Minister said that a deep-sea harbour in the vicinity of Greymouth was most desirable and if it was at all possible to build one it should be done. It had originally been estimated that the Point Elizabeth scheme would cost £1,750,000, but now it would cost between £4,000,000 and £5,000,000. The engineer to the Greymouth Harbour Board, Mr. D. Kennedy, had proposed a deep-sea harbour at Cobden, utilising the north breakwater, at an approximate cost of £1,000,000.

Before the Government moved in the matter it wanted to be reasonably sure that the scheme would be successful. Should any project be shown to be practicable he would not hesitate to recommend to the Government that a large sum of money be spent.

It was now suggested, continued Mr. O'Brien, that to meet existing demands at Greymouth, both breakwaters be extended another 400-ft.. The Chief Engineer of the Works Department had stated that this was the only thing to do in the meantime. The Government had an open mind on the question of a deep-sea harbour and any engineering proposal of merit would receive earnest consideration. Westport was a national harbour and had been so for 23 years. The Government was now taking steps to improve it and to obtain a better depth.

" The Greymouth Harbour Board is prepared to find £100,000 for the work of extending the breakwaters, providing the Government finds a similar amount," said the Minister. " I have received an assurance from a former chairman of the board that the money can be raised by increasing the wharfage rate by 2s. 6d. a ton. That is a proposal the Government will consider and you will no doubt have a decision in a short time."

The Claims of Westport

The claims of Westport were not specially represented by the deputation, but have been advocated in a press interview by Mr. Robertson, the Mayor of Westport. " In harbour board days," said Mr. Robertson, " Westport was the third port in the Dominion for the amount of shipping tonnage handled, being exceeded only by Auckland and Wellington, and is capable of becoming that again and handling all the Dominion and overseas shipping offering, providing the Government expends on the port the rich revenues received from Westport harbour endowments."

The Port of Newport (Mon.) and its Harbour Commission

By H. GILES (Clerk to the Commissioners)

Ancient History

The story of the Port of Newport goes back to Roman times and of the 20 centuries which have passed, the last one, which covers the existence of the Newport Harbour Committee, may appear but a small part.

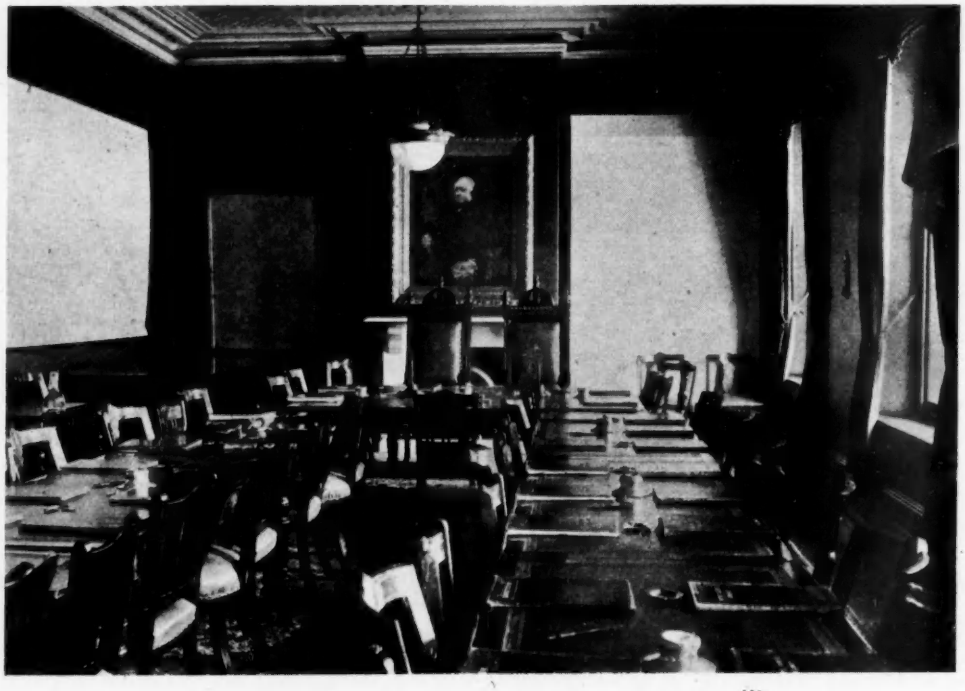
Yet from the galleys of the Romans—perhaps taking back the Second Legion from Caerleon to Rome—down to the early 19th Century, there was but little change in the volume of trade or in the methods of propelling ships, while from 1833, when the local traders were discussing making docks and introducing order into the administration of the harbour, the trade of Newport expanded at a fantastic pace.

Formation of Harbour Board

Prior to 1836, the Mayor had levied a due called " Mastage " on foreign vessels, i.e., vessels belonging to other parts. While the revenue increased with the development of trade, shipowners and traders were complaining " that great abuses exist for which there is no remedy "; berthing, pilotage, the discharge of ballast and the supply of water were all unregulated, and a Harbour Master and a Port Authority were immediate needs.

Support for the proposals was general, and so in the last year of the reign of William IV, the Harbour Board was first constituted to control shipping within the Port. The Mayor, the Corporation, the Lords of the Manors were represented as well as the shipowners, coal owners and iron smelters.

In 1890, representation was given to the Chamber of Commerce and to the Alexandra Docks and Railway Company, which was subsequently absorbed by the Great Western Railway.



Board Room of Newport Harbour Commission

Modern Progress

In 1836 the vessels arriving in the port with cargo represented 6,281 tons, and vessels loading outwards with cargo 21,137 tons. In fifty years these figures rose to 445,000 tons inwards, and 1,265,000 tons outwards, and in 1923 to 754,000 tons inwards, and 3,437,000 tons outwards. There was a falling off later when the effects of one great war were still apparent and another was brewing, but there remained in the last pre-war year a very substantial trade round the coast and overseas, which called for ever-increasing facilities for handling cargo and berthing larger vessels.

In 1836, the average size of the vessels loaded was 112 net register tons, but in 1936, it was 1,003 tons, and coal shipments in the earlier year amounted to 5,500 tons foreign, and 415,000 tons coastwise, while in the best year before the present war (1923) foreign shipments had swollen to 5,604,000 tons or a thousand times those of a century ago. Coastwise shipments reached their highest recent point in 1927—371,000 tons, actually less than in 1836.

It is perhaps of interest to note, that in the year of the foundation of the Harbour Board, Newport's coal shipments were more than three times those from Cardiff.

To-day there are 13 representatives of the Corporation (including the Mayor), 10 Shipowners, 5 Iron Smelters, 8 Coal Owners, 5 Nominees of the Lords of the Manors, and 4 of the Great Western Railway and 1 person by the Tredegar Wharf Co., while the Chamber of Commerce elects one commissioner.

Of the first Board in 1836, John Frost the Chartist, then Mayor of the town, was a member. He was later transported for his share in the riots of 1839, and it is interesting to find that the first Clerk to the Commission was Thomas Phillips, afterwards Sir Thomas, on whom as Mayor in that year fell the terrible duty of ordering the troops to fire on the Chartists outside the Westgate Hotel.

Functions of the Board

In 1942, the first floating dock was completed, and in the long street which leads to it, called Dock Street, are the Harbour Commission's offices. The dock itself is no longer used, and has been filled in, as the larger Alexandra Docks, with their direct entrance from the Bristol Channel, and their accommodation for much larger vessels, made the Old Dock unnecessary.

The development of the docks led to a decline in the use of the river wharves, and in turn to a reduction in the Commissioners' responsibility for keeping the river dredged beyond the dock entrances.

The Board however, shares with the Dock Owners—the Great

Port of Newport and its Harbour Commission
(continued)

Western Railway—the duty of maintaining the deep water channel leading to the docks.

The Board is also responsible for the buoying and lighting of the channel and the supervision of the Usk and its tributaries.

A great deal of solid matter is brought down from the hills. The tidal waters of the Severn, the Usk and the Ebbw, are heavily charged with mud: the rise and fall of the tide are swift and considerable, and constant attention is needed to prevent silting which might interfere with navigation.

It is for this reason the Board is concerned at the revival of the scheme to provide electrical power by a Barrage across the Severn, as shoals are likely to be formed, which would make the approaches to the Usk difficult, or even impossible of access for large vessels.

The Commission provides in the heart of the town a pontoon and covered accommodation for passengers for the Bristol Channel pleasure steamers.

The Board remains one of the comparatively few independent port authorities in the country. The list of its chairmen and members contains many famous names in the history of the development of Newport and South Wales and is representative of the main interests using the docks and harbour. The rapid development of the Monmouthshire coalfield and industries and the railways which serve them, has not been achieved without many a fight to preserve and extend the position of Newport as the port of the area and in those struggles the Harbour Commission has always taken a leading part.

The Government has made South Wales a Development Area; many new industries are already in Monmouthshire; many more will come, and the Harbour and Dock Authorities are ready and anxious to meet all reasonable demands for port facilities for shipments whether round the coast or overseas.

Royal Visits

On the occasion of its Centenary in 1936, the Board was honoured by a visit from the late Prince Arthur of Connaught and an inspection of the harbour was made. Many memories were recalled of the Prince's previous visit in 1914 when the New Entrance Lock to the Alexandra Dock was opened by him just prior to the last war.

Harbour Personalities

The present Chairman of the Board is Lt.-Col. W. Harold John (photograph and biographical sketch on this page), a representative of the Newport Corporation). He succeeded Capt. E. J. Spurrier, a representative of the Pilot Boat Company.

The following is a list of names of the Newport Harbour Commissioners for the year 1944-5:—

Messrs. C. H. Adams, J. Parry Brown, E. E. Cashmore, J. T. Edmunds, T. Evans, W. J. Horton, G. T. Jones, C. G. Martyn, T. F. Mooney, T. Bert Price, W. Mordey, F. W. Raikes, B. T. Rees, E. J. Spurrier, W. H. Victory, I. C. Vincent, A. R. Beatt, W. Casey, J. E. Dunn, M. G. H. Dunn, M. C. Harrison, A. James, W. H. John, N. J. McNeil, W. Pinnell, A. H. Pursey, G. F. Rainforth, Mrs. E. Rawden, W. G. Rudd, R. S. Tyack, J. S. Whitmore, J. Davison, A. G. E. J. Fudge, F. Bollon, S. I. R. Smith, G. H. Latham, D. Thomson, E. C. Lysaght, R. P. Perry, D. R. Phillips, E. D. Williams, E. Davies, R. Green, and E. P. Jones.

The Clerk is Mr. Harold Giles, who a year ago, succeeded Mr. C. C. Brewer, who had been in the service of the Commissioners for nearly 50 years. The Harbour Master is Captain A. B. Beedie.

Death of Former Dock Manager.

The death is announced of Alderman J. H. Swallow, O.B.E., J.P., who, before his retirement in 1938, was deputy chief docks manager of the Great Western Railway. He had also served on the Newport (Mon.) Harbour Board, the Pilotage Board and other maritime bodies. He was chairman of the Joint Committee for Dock Labour, a former Mayor of Newport and since 1939, Civil Defence Controller for the district.

Notable Port Personalities

XLVII—Lt. Col. W. Harold John

Councillor Lt.-Colonel W. Harold John, is one of the Newport Borough Council's representatives on the Harbour Commission and is the present chairman of that body. He has been a member of Newport Town Council since 1935. In business he

Lt.-Col. W. HAROLD JOHN.

is the principal of Messrs. W. H. John & Co., Iron, Steel and Metal Merchants. He is also the Chairman of Newport County Association Football Club, Ltd. Since the outbreak of war he has held the appointment of County Military and Air Force Welfare Officer, with the rank of Lt.-Colonel. He is also Chairman of the Newport War Emergency Council of Social Service.

He was Deputy Mayor of Newport 1938-39, and was Senior Vice-President of Newport Chamber of Trade for three consecutive years. He takes a very keen interest in all matters relating to trade and commerce, and is greatly interested in the many projects which are now being considered for the post-war development of the Town and Port.

Retirement of Well-known London Channel Pilot.

Captain Norman Woolcock, R.N.R., J.P., of Gravesend, has retired after over 53 years at sea, of which he spent nearly 36 years as a London Channel pilot. He went to sea as an apprentice in the full-rigged ship *Blair Athole* in 1891, and afterwards served in other well-known sailing ships. On obtaining his master's certificate he joined the Atlantic Transport Line in 1900. In 1909 he joined the Trinity House Pilot Service. He became choice pilot for the Atlantic Transport Line in 1913 and the Cunard Line in 1916, which positions he held up to the time of his retirement.

Correspondence

(From the President of the Institution of Civil Engineers).

To the Editor of "The Dock and Harbour Authority."

Sir, **Port Administration.**

Referring to your Editorial Comments in your issue of December last on my Presidential Address to the Institution of Civil Engineers, you express regret that I did not indicate more precisely the form of centralised control which I had in mind for the administration of British Ports in the future.

In that address I pointed out that hitherto the local administration of ports has been carried out, broadly speaking, by five different kinds of organisations, and I added that these are likely to continue. During war all ports have been under the direct control of the Ministry of War Transport. Although this will probably cease post-war, it is likely that there will be a Central Authority of some sort who could sanction and raise capital for large dock extensions, although such works might be initiated by the local authorities.

I further suggested that such a Central Authority might be a small Directorate on the lines of the London Passenger Transport Board.

In making these suggestions, I was by no means certain how far they would please my listeners and readers, many of whom have a much larger experience of port administration than I have —but I was anxious to be stimulating rather than informative, and to induce engineers and others connected with our ports, to give this matter the study it deserves. And I thought I had pictured the future Central Authority in sufficient detail for this purpose.

Now, Sir, I venture to suggest that it is up to you and to your correspondents who have experience and ideas on the subject of port management, to fill in further details, and to say how the Central Authority should be formed, and of what its duties and powers should consist, and further what shall be its relations with the other Central Authority envisaged by the Barlow Report, which, we gather, is not only to control the building and rebuilding of our towns, but also to decide what industries may be given to or taken away from them.

Southampton. Yours faithfully,

11th December, 1944. F. E. WENTWORTH SHEILDS.

[We are glad to give publicity to the President's explanation and amplification of his excellent Address, which certainly achieved the object of being "stimulating," and we cordially endorse his suggestion that our readers should express their views in these columns on this vitally important subject. —Editor].

To the Editor of "The Dock and Harbour Authority."

Dear Sir, **Tidal Levels of the Thames**

If it is not too late to comment upon Mr. Hall's series of articles on "The Origin and History of Trinity High Water," I would say it has, as the French put it, "les défauts de ses qualités." It is so exhaustive and fully documented that a busy reader might be excused for missing points of importance, "not seeing the wood for the trees." May I therefore put these two simple propositions:—

(i) The conventional Trinity High Water Level tends to be misleading because it is a horizontal line, whereas true high water is not, but varies up and down river; and

(ii) For this and other reasons, it would be expedient to establish a new Low Water or Zero datum.

Trinity High Water Level has been supposed to be established by regarding it as parallel with Ordnance Survey datum and at a constant elevation of 12½ (or more precisely 12.53) feet above it. That relationship, however, has been falsified or disturbed, not only by the existence of various and varying actual marks purporting to show T.H.W (of which I, for one, was not fully aware and feel indebted to Mr. Hall for the information given), but more by the fact of the old (or Liverpool) Ordnance datum being supplanted by the new (or Newlyn) Ordnance datum, with a varying divergence.

When stripped of these complications, however, the essential feature is that T.H.W. is a horizontal line, whereas the line of any actual tide (such as H.W.O.S.T.), is a sloping one. This is extremely simple, when known; but is it sufficiently known? As a novitiate in tidal work, thirty odd years ago, I did not find easy enlightenment. One light in particular failed. A Royal Commission had in 1902 given a Report on the Port of London and appended to it a full and painstaking statement of dimensions for all docks and entrances as then existing, including the height of water over sills at T.H.W. and at H.W.O.S.T. But, alas! the figures so given are wrong in almost every case. The relationship is rightly shown for the London and St. Katherine Docks, where H.W.O.S.T. is 1-ft. above T.H.W., but this difference of 1-ft. is wrongly shown as the same everywhere, even at Tilbury where actually H.W.O.S.T. is 1-ft. 3-in. *below* T.H.W. and the Report figure is therefore in error by 2-ft. 3-in.

This, however, I only learned later when I was fortunate enough to see a table of tide levels compiled in 1910 by Captain Dawson, Chief Marine Surveyor. From this table I was able to draw up a diagram which is here reproduced in essentials, with certain additions to suit the present purpose. This diagram illustrates the point that from Southend, at 1-ft. 10-in. below, to Teddington, at 2-ft. 3-in. above T.H.W., there is a rise of about 4-ft. in the height of H.W.O.S.T. and that the two only coincide at one point, a little below the Albert Dock entrance. An important consequence of this fact is the deceptive comparison that is made when depths of water over sills of entrances are stated as depths of sills below T.H.W. These are apt to be taken as real depths, whereas, in comparing, for example, London Dock and Tilbury Dock, the same depth below T.H.W. implies 2-ft. 3-in. less water at Tilbury.

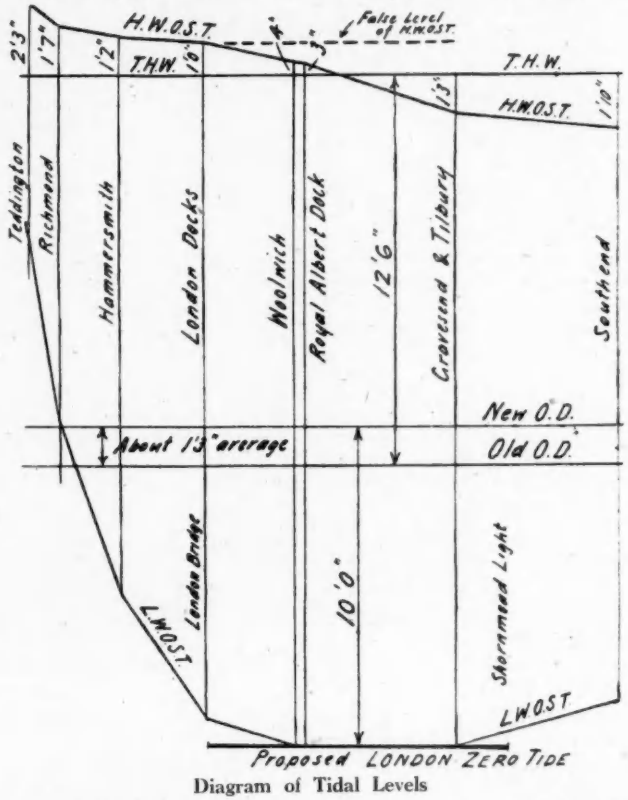


Diagram of Tidal Levels

This risk of confusion by false comparison would be much reduced by adopting Mr. Hall's suggestion and establishing a new datum based on low water. A line which I have added to the diagram at his proposed level of 10-ft. below Newlyn datum shows that it coincides nearly enough with actual L.W.O.S.T. if kept (as proposed) within the limits of London Bridge and Shornmead Light. The proposal has much to commend it and seems to merit at least a full consideration. Yours faithfully,

December, 1944. A. T. BEST, M.Inst.C.E.

Port Shipping Accommodation and the Development of Aviation

The Competition between the Aeroplane and the Luxury Liner

By CAPTAIN E. C. SHANKLAND, R.N.R.*

Dominions Royal Commission Report, 1917

Three salient features marked the lines of discussion in the Report of the Dominions Royal Commission, 1917, in regard to shipping and harbours:

(1) That the 1914-18 war abundantly demonstrated the value of sea communications within the Empire and the importance in this valuation of the Suez and Panama Canals.

(2) That the development of cheap, regular and efficient transport depends in the last resort on increase in the size and

Scottish Aviation Favours Prestwick for a Northern Hemisphere Hub

draught of ocean-going vessels, and consequently on the existence of harbours and waterways of a capacity and depth adequate to receive such vessels.

(3) Inter-Empire co-ordination of harbour improvement is essential so as to correlate and develop systematic lines.

Now it may be said that we are again at the cross-roads as an organisation of peoples dependent so much on communications. To-day trans-oceanic aviation has forced its efficiency upon us chiefly for passenger services and this fact now so evident calls for the attention of harbour authorities who, dependent upon the shipowners and their enterprise, may well wonder what they will do. To the naval architect there opens a door to further opportunity and one question which poses itself is whether the gallant fight which the leisurely ship of sail lost to the steamship, is likely to be repeated in the competition between the sea surface passenger vessel and the aeroplane.

American Port Opinion

As recently as 1928, the New York Port Authority in approving the extension of certain Manhattan Piers for the French and the Cunard Lines remarked that their horizon was limited to a stated number of years, " after which the transatlantic passenger service may be conducted by air."

The problem at New York was that of a busy waterway and the extent to which piers could be permitted to permanently reduce its manœuvring area.

The author gave written evidence on this subject in support of the pier extensions based on the conditions of manipulating liners in British harbours with much greater limitations of manœuvring space. In the accommodation for mammoth liners another consideration arises—that of the special expense for a comparatively few ships.

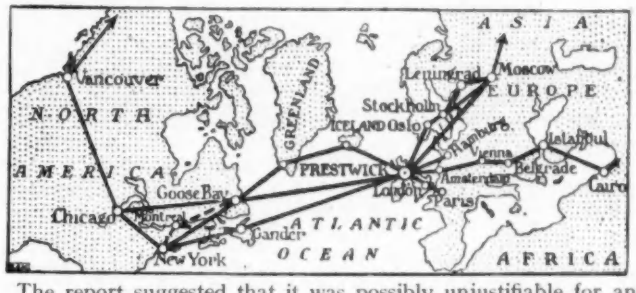
A Liverpool shipowner, himself an advocate of vessels of moderate tonnage, would frequently ask the Mersey Dock Board, " When is this race between the ship and the dock to be brought to a stop." That was in 1917. The expense of dredging alone for the accommodation of the deeper drafted liners at many places is considerable. There are exceptions, such as Southampton, the Clyde at Greenock, Le Havre and Cherbourg, where the natural deep water lies close to the harbour basins.

Experimental Model of Rangoon

The Commissioners of the Port of Rangoon with an eye on the larger vessels trading to the Far East, commissioned a well-known firm of harbour engineers and consultants to investigate the limitations of their estuary, involving a 3 years study with an experimental model coupled with hydrographic detail.

On the following points the report suggested moderation in this field of estuarial management:

A dredging programme was outlined which, with some initial expenditure and not excessive recurring maintenance dredging, would make reasonably certain of a satisfactory and permanent approach channel.



The report suggested that it was possibly unjustifiable for any port to incur large capital expenditure to benefit a small section of the trade.

Works which are constructed to benefit deeper vessels must be paid for mainly out of shipping dues. Beyond a certain point increase in dues must hamper trade as much as physical obstructions and there must be for any seaport an economic limit to the draught of shipping.

Airport Developments

These views were expressed in 1935. Meanwhile, if we may now ask the reader to switch over to the indulgences enjoyed by aviation, we find in 1937 that the Public Works Department of the Straits Settlements approved at the opening of Singapore Airport of an expenditure to date of £854,060. Here then is a sign of the changed times in communications. Mr. Donald Douglas, President of the Douglas Aircraft Company, has stated that his engineers have developed an advanced type of plane designed to carry 108 passengers and a crew of 13 with speeds of more than 300 m.p.h. These clippers to be called D.C.7's will be 4-engined and cost about ten million pounds for 26 of them, their design permitting them to navigate in the stratosphere.

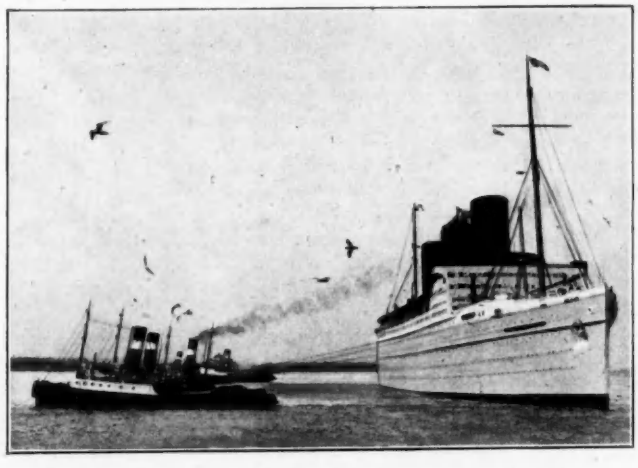
From Scotland comes the most comprehensive British declaration of commercial aviation (November, 1944) which is initiated by the Scottish Aviation, Ltd., having in its directorate some celebrated airmen. Their aspirations are aimed at an area in the Northern hemisphere which is shown on plan above. Prestwick in Ayrshire is the hub chosen as the principal terminal. There can be little doubt that Prestwick also has claims of high strategic utility, and possesses considerable meteorological advantages on data as

*Late River Superintendent and Chief Harbour Master, Port of London Authority.

Port Shipping Accommodation and the Development of Aviation—continued

a relatively fog-free district. For seven months of the year—March to September inclusive—the gale frequency for storms with a Beaufort wind velocity from 8 to 12 is low. In June the frequency is zero. Thus in the Scottish West Country so distinguished as the working ground of James Watt, Kelvin and other engineers and scientists, it is noteworthy that in aviation they have decided to " tak tent o' time ere time be tint."

Further South, Latin-American Airways, Ltd., an organisation in association with the Booth Lines, has declared designs on the continuance of this high standing steamship Company which has made the coastal plain and valley of the Amazon its particular interest for two generations of shipping. The Booth Line is of Liverpool origin and its aviation subsidiary will have a name well known in Pernambuco, Para, and Manaos in particular. Brazil by its central position in the Americas stands fair to be the great ferry terminus for aircraft taking off from Dakar in Africa.



Harbour Tugs Towing a Liner against a Broadside Wind Pressure

Economical Size of Steamship

Reverting to the Report of the Dominions Royal Commission, 1917, for material guidance on the future design of ships, we find that the question of transportation costs was uppermost in the mind and evidence of the late Sir John Biles who made this form of research his own, and who held an unique place in the prognosis of ship design.

Sir John remarked that improvements in hull structure plus economies in weight of machinery and consumption of fuel help to make the length of the ship (having minimum transportation costs) greater.

That large ships of high speed may do a service of cargo delivery on a much lower capital than slower ships. That up to a determined length of ship the cost of transportation decreased with the increase of length, if breadth and draught be increased in proportion.

That the determined length up to which transportation cost decreases with increase of length, is greater, the greater the speed. That if draught be not increased, with increase of length, the cost of transportation steadily increases.

The draughts corresponding to length on the foregoing basis would approximate

Length	...	800-ft.	900-ft.	1,000-ft.
Draught	...	46-ft.	52-ft.	57.6-ft.

By 1927 Sir John had occasion to revise his views for a report on channel development where future depth was important in order to fix a level for tunnels passing under the channel. His remarks led to the speed relation of such vessels and his conjecture was as follows—for medium transportation costs:

14 knots: About 800-ft. length or 10% better than 600-ft.
17 knots: About 900-ft. length or 30% better than 600-ft.

20 knots: About 1,000-ft., an even greater cost and freight improvement.

The utilisation of higher steam pressures and temperatures which have been contingent upon metallurgical advances are now promoting some of the economies in construction foreshadowed by Biles. Incidentally it would appear to be only a matter of time before the results of metallurgical research will provide more suitable alloy metals for all parts of modern engines, with the consequent reduction in weight and of longer durability in service. All these improvements depend on the inventiveness and research of man. Of ourselves.

It is the task of statesmen to bring about a better understanding among the nations, but why leave everything to statesmen?

When Lord Devonport, Chairman of the Port of London Authority, urged his Board to make a channel 40 miles in length to King George V Dock in the heart of the Port from the sea at an ultimate cost of two millions, he was supported by an enterprising shipowner, Charles Franklin Torrey of the Atlantic Transport Line, by whose initiative the vessels *Minnewaska* and *Minnetonka* were built with a load draught of approx. 37-ft. The dividend of this channel enterprise probably occurred in 1938 when the returns showed an overseas trade for London in 42 million tons of goods—with an approximate valuation of £650 millions sterling.

The Port of Rotterdam

Devastation of the Port Equipment by the German Army

The following particulars of the havoc wrought by the retreating German army on leaving the Port of Rotterdam have been received by the Netherlands Government in London:

Premises.	Damages.
Vulcaan	Pump installations of the docks destroyed and docks sunk
Rotterdamsche Droogdok My.	
Wilton Shipswarf	Building and launching sheds destroyed. Machinery destroyed.
Gusto Shipswarf	
Piet Smit Shipswarf	Machinery, cranes, warehouses blown up.
Burgerhout Aluminium Factory	Caught fire. Considerable damage.
Van der Giessen Shipswarf	Surrounding factories and wharves completely destroyed.
Boele Shipswarf	
Pot Shipswarf	
Nieuwe Waterweg Docks	Pump installations destroyed, docks sunk.
Thomson's Havenbedrijf, North side of Maashaven	Harbour installations, cranes and warehouses all completely destroyed.
P. A. Van Es & Co., North side of Maashaven	
Furnes' Scheepvaart My. (and others), North side of Maashaven	
Steenkolen Handelsvereeniging, North side of Maashaven	Quays blown up.
Holland-Amerika Lijn, Rijnhaven	Warehouses " Cuba " and " San Francisco " blown up.
Petersen, Rijnhaven	Grain and other warehouses destroyed.
Pakhuismeesteren, North-east side Rijnhaven	Buildings of these firms severely damaged. Foundations shifted by explosions. Further collapses of warehouses, sheds, etc., expected.
Handelsveem, North-east side Rijnhaven	
Blaauwhoedenveem - Vriesseveem, North-east side Rijnhaven	
Mueller, North side Rijnhaven	Warehouses and banana warehouse destroyed. No quayside left at all.
Presto's Stuwadoor'sbedrijf, North side Rijnhaven	All cranes gone, the quay is crumbling.
Municipal Docks, Dokhaven	Docks I., II. and III. have been sunk and their pump installations destroyed. Dock IV. sunk at the entrance of the Maashaven.
Swarttouw, West side of Waalhaven	Large loading bridges, etc., blown up.
Nederlandsch Havenbedrijf, West side of Waalhaven	Harbour installations completely destroyed.
Nederlandsch Havenbedrijf, East side of Waalhaven	All cranes and harbour installations destroyed. Submarine base blown up.
Hudig, West side Merwedehaven	All quays, cranes, warehouses, etc., blown up.
Pieters, West side Merwedehaven	
S.N.V., West side Merwedehaven	
Shell, Pernis	All petrol tanks completely destroyed. Pipelines and refineries also blown up.
A.P.C., Pernis	
Pakhuismeesteren (and others), Pernis	
Oude & Nieuwe Matex, Vlaardingen	Completely destroyed.
Rotterdam Lloyd	All quays, warehouses, cranes, etc.. destroyed.
Wambersie	All quays, warehouses, cranes, etc., destroyed.
Parkhaven, Jobshaven and Schiehaven	All quays blown up (deep holes were made in the quays and time bombs were laid under the surface of the water).

Notes of the Month

Impending Closing of Amlwch Harbour.

Application is being made by the Amlwch Urban District Council, Anglesea, to the Board of Trade for authority to close the local harbour. At one time the port handled a large tonnage of copper ore from adjacent mines, but the harbour revenue has now fallen to a little over £70 per annum.

New Transporters at Varberg.

An additional cargo handling facility is to be provided at the Swedish Port at Varberg, in the form of a transporter with end elevators, estimated to cost 50,000 kroner. The installation is being made by the Town Council who will lease it to the Svenska Cellulosabolager for use at that Company's warehouse at the quayside.

New Quay at Sao Roque.

A quay, 130 metres in length with 24-ft. of water alongside at low tide, has recently been completed at Sao Roque on the Bay of Bahia near the mouth of Paraguassu River, South America. It is announced that the new quay is not yet equipped with cargo-handling appliances, but that an installation of cranes is contemplated, together with the construction of a storage shed for goods.

Glasgow Quayage Development.

The Clyde Navigation Trust have recently approved of plans for the construction of a new riverside quay, estimated to cost £2,235,000, towards which a grant from the Government is to be applied for. The quay is to be of a length of 4,150-ft. between Renfrew and Shieldhall, the frontage being set back 150-ft. behind the present river bank, to admit of the future widening of the waterway.

Clyde Navigation Trust.

At a meeting at the end of November, Mr. William Cuthbert, chairman of Clyde Navigation Trust since 1939, was re-elected to the position and Mr. James Leggat was re-elected deputy-chairman. Mr. Cuthbert said that the Trust had reason to congratulate itself on the valuable contribution it had made to the war effort. This had been made possible by the excellent way in which officials, staff, and employees had overcome many difficulties.

Seafaring Boys' Club at Liverpool.

The recent opening of a club at Liverpool for Seafaring Boys was accompanied by a reception held at the Mersey Mission to Seamen, at which were present, among other officials and distinguished personages, Admiral J. W. Dorling, Flag Officer in Charge at Liverpool, and Mr. R. J. Hodges, general manager and secretary of the Mersey Docks and Harbour Board. Sir Sydney Jones, shipowner and former Lord Mayor of Liverpool, performed the opening ceremony.

Proposed Fishing Fleet for Wick.

At a special meeting of Wick Harbour Trustees and delegates from the Scottish Co-operative Society, held recently to discuss the proposal that the Society should base a fishing fleet at Wick, Mr. William Manson, chairman of the Trust said that Wick was taking a long-sighted view in inviting the Co-operative movement to centre its future activities in Wick. The situation in Wick was serious. They had no fleet, practically speaking, and there was plenty of room in the harbour for Co-operative vessels as well as individual-owned boats. As a member of the Trust and a substantial ratepayer, he not only welcomed the Co-operative Society, but in the interests of the community would offer them every facility.

Following discussion and questions, it was stated that a full report would be laid before the Co-operative headquarters and a decision intimated later. No commitments were made by either side.

South Wales Docks Managership.

In succession to Mr. W. J. Thomas, who has just retired, Mr. Leslie E. Ford has been appointed Chief Docks Manager of the Great Western Railway Company at Cardiff.

Campbeltown Harbour Appointment.

Mr. Archibald McKillop has been appointed Harbour Convener by the Campbeltown Town Council in succession to Bailie G. Ralston Thomson.

Dundee Harbour Board.

At the annual general meeting of Dundee Harbour Board on the 22nd of November, Mr. H. Giles Walker was unanimously re-elected chairman, Mr. R. B. Graham as deputy-chairman. Provost Alexander Smith, Monifieth, Colonel J. B. Muir, Mr. David Mudie, and Mr. Archibald Rettie were re-appointed conveners of standing committees.

Reduction in London Dock Charges.

Following cuts in the rates of percentage contributions to the National Dock Labour Corporation, both the Port of London Authority and the London Association of Public Wharfingers, Ltd., have made reductions in their rates and charges, which became operative on December 1st.

Institute of Transport Annual Report.

The Annual Report of the Council of the Institute of Transport for the year ended 30th September, 1944, shows a total membership at that date of 5.796 as compared with 5,327 at September, 1943, and 5,053 at September, 1939. Special allusion is made to the Henry Spurrier Memorial Trust, and in connection therewith the withholding of any award " as conditions continued to make such an award impracticable " and to the examinations with 600 papers worked, as against 584 in 1943. There were a good number of candidates at prisoner-of-war camps and question papers were sent to them without, however, news of receipt.

Development of Port of Malmö.

Post-war improvements at the Swedish port of Malmö are under consideration, involving an expenditure of some ten to twelve million kroner. The proposed works include the replacement of the existing railway swing bridge by a large fixed bridge, and the transfer of the berths for the regular Copenhagen vessels from their position opposite the post office to the quay on the other side of the Inner Harbour, where new Customs sheds will be provided, in conjunction with a six-storey building containing offices and warehouse space. In the Nyhamn the south quay is to be widened by 20-30 metres and a large warehouse similar to those in the Free Port will be built, while powerful cranes will be installed.

Bristol Port Improvements.

At a recent meeting of the Bristol City Council, Alderman A. W. S. Burgess, chairman of the Port of Bristol Authority referred to the subject of post-war port improvements, which, he said, was receiving every attention.

Answering a question put by Mr. A. L. Duggan, Alderman Burgess said: " A great deal of consideration has been given by the Docks Committee to the re-establishment of trade, including export trade, after the war. The port equipment in general is already highly modernised, and its improvement in accordance with technical and trade developments is constantly under review."

Replying to another question by Mr. Duggan, Alderman Burgess said the Docks Committee had already formulated plans for dock developments on the former Prince's sheds and granary sites (also City Docks), which would preclude the provision of a coal-tip in the vicinity. Past experience had proved that the demand for coal-tipping appliances in the port had not justified their provision.

The Human Element in Transport

Excerpts from Inaugural Address of Mr. Robert Kelso, President of the Institute of Transport, November 13, 1944

This evening I propose to deal with some facts I have observed during my business experience as a shipowner, partly in the coastwise trade around our coasts and partly in the trade between London and the Continent of Europe. . . ,

Continental Port Competition

About ports, many of you no doubt know of the keen competition that existed between some of the main Continental ports such as Hamburg, Rotterdam, Antwerp and Dunkirk. These ports constantly cut one another's rates in order to attract ships and their cargoes to them, so much so that Hamburg, Rotterdam and Antwerp undoubtedly made every year losses the extent of which could never be exactly known, as they were smothered in their Municipal or State figures, but which were certainly considerable. This uneconomic competition harmed some of the leading British ports such as London, Southampton, and Liverpool, all of which have, of course, to pay their expenses out of their income. Not only did the ports of one Continental country compete with the ports of another, but even between ports in the same country keen competition was the rule. For instance, Hamburg and Bremen fought one another keenly; so did Amsterdam and Rotterdam; and so, to some extent, did Antwerp and Ghent. The Continental view seemed to be that it was worth while to lose even considerable sums of money in the running of a port, provided thereby ships and cargoes were attracted to the port. In France, the State provided halt the initial capital and maintenance cost of ports, the French view being that all citizens had an interest in the welfare of their ports and should therefore contribute something to their cost. There is perhaps more to be said for this outlook than we are inclined to admit.

I have so far dealt with the keenness of the competition in transport that prevailed on the Continent—competition between country and country, between port and port, and between railway and railway. I suppose it is true to say that cut-throat competition cannot normally be carried on indefinitely, because it must result in the survival of the most efficient (in the art of survival) and the disappearance of the others. This rule can apply only to private enterprise or any other similar system that is obliged to produce out of its own earnings the money required to replace the absolescent tools of its trade. The rule does *not* apply to the Continental competition I have mentioned, as the losses incurred therein were met to a large extent out of public funds.

* * * * *

Psychological Factor in Transport

I think no solution of post-war internal transport will be satisfactory if it confines itself to the mechanics of the problem and to a set-up for administration and operation while leaving out of consideration what I really think the most vital factor of all, namely, the spirit of the men who have to do the work. I know that proper living conditions and pay will have to be provided for all workers, but the proper sense of pride in doing one's work well does not depend only on comfort and pay, although these, of course, are indispensable. More is required. Nor is it enough that the men responsible for administration and management should be constantly kind and generous to all employees under them. It is not mere kindness that is needed from the top, but a real sense of appreciation and gratitude for the spirit of effort and the loyalty displayed. In short, it is the family feeling which should prevail and which I think exists and always has existed in most of the old transport companies that you and I know. If nationalisation would create this feeling of loyalty and inspire men to their best effort, and if it will do this more certainly than any other system, then nationalisation should be welcomed. If some kind of public board would do this still better, that's a great point in its favour. If, on the other hand, loyalty and maximum effort are more readily found in the ranks of the companies who have been running for years on the basis of free enterprise, this important fact should be well borne in mind, and the Government should think long and gravely before they decide to abandon such a source of loyalty and efficiency. If the Government decides to keep the companies going, as I hope they will, then they must also give them conditions that permit them a fair chance of healthy survival.

May I summarise the points I have taken the liberty of putting before you:

1. I have tried to remind you that man liveth not by bread alone, nor yet by machinery and thoughtful lay-out of administration alone. More is required. A full chance must be given him to ensure that the spirit in which he does his work shall be the right spirit.

2. I have tried to hint that it should be an important part of our Government's policy as will give free enterprise in transport a fair chance of functioning successfully, for without the spur of free enterprise the incentive to constant improvement will be blunted and total production thereby diminished.

3. Another duty our Government should perform is to take note of and counter any subsidising by foreign governments to the detriment of British industry.

Port of Bombay

Reparation of Devastated Dock Area

An announcement has been made by the India Office that the Bombay Docks system, so terribly devastated by the explosions in April last, as described in the October issue of this Journal, has been rehabilitated and brought into commission again. The work, which was carried out by the military authorities, necessitated a vast amount of reconstruction, with which certain improvements have been incorporated.

The major work was in the immediate area of Victoria Dock, where the explosions, which were seismographically recorded more than 1,000 miles away, occurred. More than a million tons of rubble had to be removed. To carry out this task hundreds of soldiers, who became known as the " mudlarks," worked up to their necks in filth and slime. The rebuilding of the quay wall was a notable piece of work, which for economy of time and labour and the utilisation of materials on the spot was a world record.

Reconstruction of the docks area led to redesigning, which aimed at improved working facilities. Six miles of new rail track now give better access to quays. More than 20 acres of devastated land has been newly paved, over a million square feet of shedding has been built or reconstructed, and many new buildings provided. In addition, three swing bridges have been repaired, a new sea water main for fire-fighting has been laid, and subterranean fire pumping units installed. Nearly 100 hydraulic cranes and the equipment for working them have been restored, and oil pipe-lines have been put down. Indian Army craftsmen and pioneers formed the majority of the 1,000 men employed. They were led by British Army engineers and were helped by West African artisans and Italian prisoners of war.

Channel Deepening at Newfoundland Harbour.

Dredging operations recently in progress at the entrance to St. John's Harbour, Newfoundland, for the deepening of the Narrows and the removal of an extensive ledge of rock, have been suspended for the winter season. A mean spring tide low-water depth 39-ft. has now been secured. It was hoped to obtain a depth of 40-ft. in the channel, but investigation has shown that to secure the extra foot would involve extensive blasting at heavy expense, besides carrying the work into another season, so in all probability the authorities will be satisfied with the average 39-ft. which has been secured. As there are only five or six piers in the harbour which can accommodate ships drawing 29 to 30-ft. of water, the 39-ft. channel now provided would appear to be quite ample for ordinary uses. By waiting for high spring tide and smooth water a ship drawing over 40-ft. could be brought in. Whether any further operations will be undertaken remains a matter for the Government to decide.

Dolphins

Their Stability and Resistance to Impact

By R. R. MINIKIN

One of the most tantalising jobs that a harbour engineer has to deal with is the design of an efficient dolphin to arrest the lateral movement of vessels approaching a mooring berth, dock-gates, floating docks and the like. The broad facts are that the kinetic energy of a vessel moving through the water has to be nullified and absorbed by a construction which will not be so rigid as to damage the vessel by sudden unyielding collision and not so weak that it will "give" before the vessel's impact to the point of fracture or collapse. The happy mean is a structure so constructed as to gradually decelerate the lateral or sideways motion of the vessel without injury to either body. Obviously a suitable medium would be a spring or buffer which deflects under impact and absorbs kinetic energy. Then the problem would be resolved into the satisfactory design of a structure which will provide an efficient support for any such restraining medium inserted between the vessel and the dolphin. In fact it is not so simple, for the reason that the common siting of these structures is usually in river or estuarial beds of poor load-supporting qualities, necessitating the construction of comparatively light frames in disadvantageous conditions and frequently harassed by the range of tides. The economic point of view also imposes a limit upon the measures to be adopted, and in all cases the navigating fairway must not be encroached upon. It is therefore easily understood why most dolphins are constructed of a piled system supporting a rigid deck. There are, however, examples of solid construction; cylindrical piers, and patented devices which so far, all things considered, have not proved any more efficient than the general type.

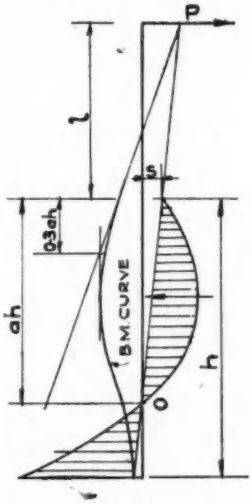


Fig. 1.

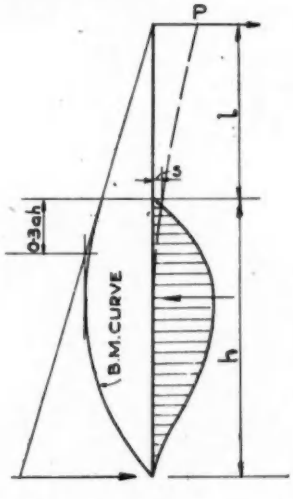


Fig. 2.

Main Factors for Consideration.

The main factors to consider are: The elasticity of the ground; the supporting power of the ground; the elasticity of the structure under the blow of the vessel; and the deadweight of the structure. The bearing capacity of piles in different strata is nowadays easily computed or approximated to by the several modern formulæ in current use, but what is not so easily assessed is the quantitative value of the blow. It is natural that any engineer concerned with the construction of dolphins will have good arguments to support his eventual selection of preliminary assumptions, but not infrequently the main argument is that "it was done like this before"—"by so and so." Maybe this is a sound practical reason, but it is fraught with many hazards, as conditions are not always the same and as likely as not the original assumptions may be unknown or merely lucky guesses. It would therefore be of advantage to consider the problem from first principles, and to so co-ordinate the factors as to give rise to few assumptions incapable of proof.

Since the eventual resolution of all forces on the dolphin must pass into the ground, let us first consider in what way the embedded length of the pile affects that portion above bed level. A pile driven into medium homogeneous ground and subjected to a horizontal force at some height l above surface level is kept in place by a ground couple of resisting forces distributed over the embedded portion, as shown in Fig. 1, where the ordinate to the curve at any point represents the intensity of pressure at that point. The equation to the curve is

$$P=mC_3s\int_0^h\left(x-\frac{x^2}{ah}\right)dx \quad \ldots\ldots\ldots\ldots\ldots(1)$$

and taking moments about O, the point about which the pile is assumed to turn

$$P\,(l+ah)=mC_3s\int_0^h\left(x-\frac{x^2}{ah}\right)(ah-x)\,dx \quad \ldots\ldots\ldots(2)$$

From these two expressions it can be shown that the virtual free length of pile is $l+0.3\,ah$, where

P=horizontal force at height l above bed level.
mC_3=hydraulic equivalent of passive resistance.
x=any depth below bed level.
ah=depth of fulcrum below bed level (average value of a=0.725).
h=embedded length of pile.
s=movement of pile at surface of ground.

Now the assumption in this case is that the pile remains straight, which is obviously not in accordance with actual fact, excepting in the case of a very stiff pile in soft ground. As the author has shown elsewhere (*Structural Engineer*, Vol. XXI, No. 8), the more usual case is where the toe of the pile rests in firm ground and the embedded portion bends under the force as shown in Fig. 2, where the expression for the pressure resistance curve of the ground is

$$P=mC_3s\int_0^h\left(x-\frac{2x^2}{h}+\frac{x^3}{h^2}\right)dx \quad \ldots\ldots\ldots\ldots(3)$$

and

$$P\,(l+h)=mC_3s\int_0^h\left(x-\frac{2x^2}{h}+\frac{x^3}{h^2}\right)(h-x)\,dx \quad \ldots\ldots(4)$$

As before, it will be noticed that the resultant bending moment diagram indicates that virtually the point of fixity is at approximately 0.3ah below ground surface; in other words, the virtual free length of the pile depends upon the nature of the strata in which the pile is driven. In effect this means that a length of pile $l_1=l+0.3ah$ acts as a cantilever spring to take the horizontal force due to the collision of a vessel with a dolphin.

Now the equation to the elastic curve of a beam with moment of inertia=I ins^4 and subjected to a force giving a moment M is $M=EI\frac{d^2y}{dx^2}$, where the single integration will give the slope and the second integration the deflection. Should, then, a single pile be subjected to a bending moment Pl_1 it will have a maximum deflection of $\triangle=\frac{Pl_1^3}{3\,EI}$ and the work done by the force on the pile is $\frac{\triangle P}{2}$. Now if the source of this force is a vessel moving towards the pile and the whole of the kinetic energy is absorbed by the blow, then we get $\frac{\triangle P}{2}=\frac{Wv^2}{2g}$ on the assumption that no other forces oppose the expendable energy of the moving vessel. To avoid ambiguity let us write $\eta\,\frac{Wv^2}{2g}=X$ where η=some coefficient, and represents the portion of the total energy of the moving vessel which can be expended on the pile, so that we now have

$$\frac{\triangle P}{2}=X=\frac{P^2\,l_1^3}{6\,EI} \quad \ldots\ldots\ldots\ldots\ldots(5)$$

If this pile is connected to a number of other piles of varying lengths by a rigid deck, where the condition is that instead of being

Dolphins—continued

free cantilevers they are fixed at the bottom and fixed free at the top, then as shown in Fig. 3, $\triangle_1=\frac{P_1 l_1^3}{12 EI}$ and as each pile must take a proportion of the work done by the blow

$$X=\frac{\triangle P}{2}=\frac{P_1^2 l_1^3}{24 EI}+\frac{P_2^2 l_2^3}{24 EI_2}+\frac{P_3^2 l_3^3}{24 EI_3}+\cdots\frac{P_n^2 l_n^3}{24 EI_n} \quad \ldots\ldots(6)$$

As it is customary to drive piles of equal cross section, it may be taken $I_1=I_2=I_n$ and assuming that all deflections are equal,

$$\frac{P_1 l_1^3}{12EI}=\frac{P_2 l_2^3}{12EI}=\frac{P_n l_n^3}{12EI}$$

then

$$P_n=\frac{P_1 l_1^3}{l_n^3}$$

inserting in (6)

$$X=\frac{P_1^2 l^3}{24EI}+\left(\frac{P_1 l_1^3}{l_2^3}\right)^2\frac{l_2^3}{24EI}\cdots+\left(\frac{P_1 l_1^3}{l_n^3}\right)^2\frac{l_n^3}{24EI} \quad \ldots\ldots(7)$$

Now if, as suggested by Professor Anderson, we consider the relative stiffness of the individual piles forming the system on the basis of $k=I/l$ or $kl=I$, since I is constant for all piles the expression (7) may be written

$$X=\frac{P_1^2 l_1^2}{24Ek^4}\Sigma k^3 \quad \ldots\ldots(8)$$

then

$$P_1^2 l_1^2=\frac{24\,E\,k^4 X}{\Sigma k^3}$$

and as the bending moment $m_1=\frac{P_1 l_1}{2}$ for the condition stated, that is, with rigid decking and tops of piles fixed free,

$$m_1=n\,k_1^2\frac{\sqrt{X}}{\sqrt{\Sigma k^3}}$$

$$m_2=n\,k_2^2\frac{\sqrt{X}}{\sqrt{\Sigma k^3}}$$

. . . . . .

$$m_n=n\,k_n^2\frac{\sqrt{X}}{\sqrt{\Sigma k^3}} \quad \ldots\ldots(9)$$

where $n=\sqrt{6E}$ which for reinforced concrete with $E=3\times10^6$ lbs. is 4.242 and for steel at $E=3\times10^7$ is 13.416.

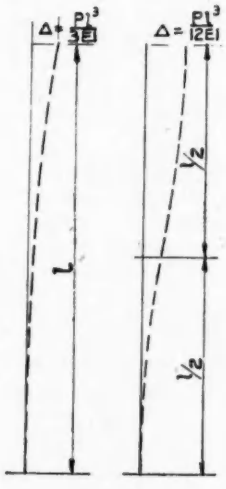


Fig. 3

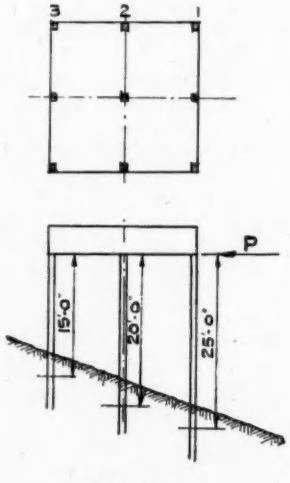


Fig. 4.

Tabular Values.

The following tables give values for k, k^2 and k^3 for different lengths and moments of inertia of piles, and also the value of X for n=1, and varying velocities for a deadweight of 1,000 tons. Any intermediate values may be obtained by interpolation or an extension of the tables.

Now as deflection $\triangle=\frac{P l^3}{12EI}$ for the considered condition by inserting values as obtained above,

$$\triangle=n\frac{\sqrt{X}}{\sqrt{\Sigma k^3}}\times\frac{I}{6E}$$

$$=\frac{I\sqrt{X}}{n\sqrt{\Sigma k^3}} \quad \ldots\ldots(10)$$

but if the top of the piles are considered as hinged only, then

$$\triangle=\frac{P l^3}{3EI}$$

$$=\frac{2I\sqrt{X}}{n\sqrt{\Sigma k^3}} \quad \ldots\ldots(11)$$

TABLE 1. VALUES OF X FOR VESSEL OF 1,000 TONS DISPLACEMENT.

Velocity. Inches per second	$X=n\frac{Wv^2}{2g}$ inch lbs. n=1 W=1,000 tons	Velocity. Inches per second	$X=n\frac{Wv^2}{2g}$ inch lbs. n=1 W=1,000 tons
1	2,900 inch lbs.	7	142,000 inch lbs.
2	11,600 ,,	8	185,500 ,,
3	26,100 ,,	9	234,820 ,,
4	46,385 ,,	10	289,900 ,,
5	72,475 ,,	11	350,780 ,,
6	104,365 ,,	12	417,450 ,,

TABLE 2. VALUES OF $k=\frac{I}{l}$

Virtual length of pile for bending	Moments of Inertia. Inch Units 150	200	300	400	500	600	700	800	900	1000
15 feet ..	0.833	1.110	1.66	2.22	2.78	3.33	3.90	4.44	5.00	5.55
20 ,, ..	0.625	0.833	1.25	1.66	2.08	2.50	2.92	3.33	3.75	4.16
25 ,, ..	0.500	0.660	1.00	1.33	1.66	2.00	2.33	2.66	3.00	3.33
30 ,, ..	0.416	0.550	0.83	1.11	1.39	1.66	1.95	2.22	2.50	2.78

TABLE 3. VALUES OF k^2.

Virtual length	Moments of Inertia. Inch Units 150	200	300	400	500	600	700	800	900	1000
15 feet ..	0.69	1.23	2.78	4.93	7.73	11.10	15.21	19.71	25.00	30.80
20 ,, ..	0.39	0.69	1.56	2.78	4.32	6.25	8.53	11.10	14.06	17.30
25 ,, ..	0.25	0.43	1.00	1.78	2.78	4.00	5.45	7.10	9.00	11.10
30 ,, ..	0.17	0.30	0.69	1.23	1.93	2.78	3.80	4.92	6.25	7.73

TABLE 4. VALUES OF k^3.

Virtual length	Moments of Inertia. Inch Units 150	200	300	400	500	600	700	800	900	1000
15 feet ..	0.578	1.37	4.63	10.94	21.48	36.92	59.31	87.52	125.00	170.95
20 ,, ..	0.244	0.57	1.95	4.63	8.99	15.62	24.89	36.92	53.15	71.99
25 ,, ..	0.125	0.29	1.00	2.37	4.63	8.00	13.31	18.82	27.00	36.92
30 ,, ..	0.072	0.166	0.57	1.37	2.68	4.57	7.41	10.94	15.62	21.48

EXAMPLE.

To investigate the value of a dolphin as shown in Fig. 4 constructed of steel piles, such as the Larrsen B.P.3 section, with moment of inertia of 465 ins.^{4} units and modulus of 81.5 inch units. It is subjected to the collision of a vessel of 750 tons displacement at a velocity of 1 foot per second.

By interpolation from the above tables—

Length of pile	Row	k	k^2	k^3
25 feet	1	1.57	2.46	3.87
20 ,,	2	1.93	3.72	7.19
15 ,,	3	2.58	6.65	17.17

$\Sigma k^3=28.23\times3$ bents

$=84.69$

Dolphins—continued

From Table 1, KE of vessel X=312,000 in. lbs. and n_1=13,416, then bending moments of piles=$\frac{P\,l}{2}=13416\ k^2\frac{\sqrt{X}}{\sqrt{\Sigma k^3}}$

$$m_1=13,416\times2.46\times\frac{\sqrt{312,000}}{\sqrt{84.69}}$$
$$=816,000\times2.46$$
$$=2,000,000 \text{ in. lbs.}$$
$$m_2=816,000\times3.72$$
$$=3,040,000 \text{ in. lbs.}$$
$$m_3=816,000\times6.65$$
$$=5,430,000 \text{ in. lbs.}$$

Now as m=fz

$$f_1=\frac{2,000,000}{81.5\times2240}=10.8 \text{ T. per sq. in.}$$
$$f_2=\frac{3,000,000}{81.5\times2240}=16.5 \text{ T. ,,}$$
$$f_3=\frac{5,430,000}{81.5\times2240}=29.5 \text{ T. ,,}$$

which shows that Row 3 of piles is greatly overstressed ; but there are other considerations which will modify this :

$$\triangle=\frac{I\sqrt{X}}{n\sqrt{\Sigma k_3}}=\frac{465}{13416}\times60.8=2.1''$$

and $\frac{2.1\times P}{2}=312,000,$

whence P=300,000 lbs.=134 tons.

From which we deduce the spring value of the dolphin=$\frac{134}{2.1}=64$ tons per inch approximately. Now if it is assumed that the dolphin is protected by the placing of suitable cushioning fenders such as, say, springs of 15 tons per 5″ depression value, that is 3 tons per inch, and six springs are used, then $d_1=\frac{64}{6\times3}=3\frac{1}{2}''$ depression of the springs to cause 1″ deflection of the dolphin, so that the total deflection is $1''+3\frac{1}{2}''=4\frac{1}{2}''$. Hence the equivalent spring value of the system is now $\frac{64}{4.5}=14.22$ tons per inch depression. Therefore the actual deflection of the fendered system on the basis of work done is

$$\frac{\triangle^2\times14.22}{2}=\frac{312,000}{2240}$$

and $\triangle=4.35''$.

Thus it follows that by a suitable fendering the blow on the dolphin can be appreciably reduced in intensity, and consequently the stresses in the members ; in this case the reduction is 50 per cent., giving f_1=5.4 T., f_2=8.25 T. and f_3=14.75 T. per sq. inch, which are within allowable limits for the structure.

If in place of a steel pile construction the dolphin is built up of 18″ square reinforced concrete piles, 4 per cent. reinforcement with moment of inertia of 15,000 in.^{4} concrete units, then we would get the following : X would be as above=312,000 in lbs. and n_1=4.242, and the modulus of section=Z=1666.6 ; then, from the above tables—

Length of pile	Row	k	k^2	k^3
25 feet	1	50.0	2500	125,000
20 ,,	2	62.5	3900	244,000
15 ,,	3	83.3	6930	578,000
				947,000
				3 bents
				Σk^3=2,841,000

Bending moment=$\frac{P\,l}{2}=4.242\ k^2\frac{\sqrt{312,000}}{\sqrt{2,841,000}}$

and

$$m_1=4242\times2500\times0.33$$
$$=3,500,000 \text{ in. lbs.}$$
$$m_2=4242\times3900\times0.33$$
$$=5,500,000 \text{ in. lbs.}$$
$$m_3=4242\times6930\times0.33$$
$$=9,700,000 \text{ in. lbs.}$$

from which f_1=2100 lbs., f_2=3300 lbs. and f_3=5800 lbs. per square inch compression on concrete, which is obviously too high : deflection

$$\triangle=\frac{15,000}{4242}\times0.33=1.18''$$

and

$$P=\frac{312,000\times2}{1.18\times2240}=235 \text{ Tons.}$$

The spring value of structure=$\frac{235}{1.18}=200$ T. per inch. To bring the deflection down to $\frac{1}{2}''$ and using the expedient of springs, as in the above example, to reduce the maximum intensity of pressure ; say nine springs, of same value as in former example, are used, then the spring compression (equivalent)=$\frac{100}{9\times3}=3\frac{3}{4}''$, so that the total deflection would be $\frac{1}{2}''+3\frac{3}{4}''=4.25''$, giving for the structure and fender system a spring compression value of 23.5 tons per inch. From this the reduced deflection under the collision is

$$\triangle=\frac{\sqrt{312,000\times2}}{\sqrt{23.5\times2240}}=3.43''$$

and P=23.5×3.43=81 T.

Therefore by the use of fenders the maximum intensity of stresses in the pile rows is reduced to f_1=720, f_2=1150, and f_3=2000 lbs. per square inch—which are reasonable for the job.

Conclusion.

From the foregoing it will be remarked that we have considered in the examples the whole of the kinetic energy of the moving vessel as actively employed in deflecting the dolphin, and also that the elasticity in ground has been neglected. Only on rare occasions does a navigated ship bump a dolphin or jetty in a direction such as to deliver the whole of the lateral energy to the point of collision, and even then an appreciable percentage of it is lost on impact. The embedded length of the pile is elastically held in the ground, which within limits contributes its share of deflection to the structural deflection and still further reduces the inteusity of maximum pressure of the collision. The question of fendering is most important, as will be gathered from the above examples. For simplicity it has been considered in the form of springs which are being used to increasing extent, but more frequently the fendering takes the form of rope cushions, coils, rubber blocks, brushwood, timber, and timber piles, or combinations of several of these materials.

In conclusion, the author would emphasise that frequently carefully computed structural stresses are brought to naught by injudicious design of the fendering. It is particularly dangerous to secure heavy or square edged rubbing strips too securely to the fenders of dolphins, as the proud edges of a vessel's plating or the projecting hinges of cargo doors may endanger the effective functioning of the whole fendering system. To avoid such an occurrence, expendable heavy rope coils or hanks of old rope suspended to take first contact, and to roll with the ahead motion of the ship whilst playing their part in the damping of the lateral motion for which the dolphin is provided, will be found most effective.

Legal Notes

1—Efficiency of Craft Moorings in Dock

An interesting case, bearing on the security of craft moored alongside a quay in the vicinity of a dock entrance, was heard recently in the Admiralty Court. Daniels Brothers (Whitstable), Ltd., the owners of the sailing barge *Trilby* claimed damages against Lieut.-Comdr. Charles E. Hall, R.N.R., commanding H.M.S. *Princess Astrid*, for injuries to their vessel resulting from a collision at the entrance to the King George V Dock, Woolwich, on the evening of April 15th, 1943. The case was heard by **Mr. Justice Pilcher,** who reviewed the circumstances in his summing up.

Mr. Justice Pilcher, giving judgment finding the barge solely to blame for the collision, said the *Princess Astrid* was an ex-channel steamer in the service of His Majesty. She was passing through the lock from the Thames into the King George V dock, and the barge was moored in the dock to the north of the north wall of the lock, with her stem from 4-ft. to 8-ft., as he found, from the line of the lock wall. She had a rope from her port bow cleat to a sheave on the northern knuckle; a rope from her main hawse leading to a bollard on the quay, and a rope from her after snatch (a form of cleat) leading astern to a bollard on the quay, 15-ft. or 20-ft. astern of her.

All the ropes were said to have been hove hand-tight by the master of the barge and his mate. The barge was seen in this position by two or three employees of the Port of London Authority and no one appeared to have commented on her position or the method in which she was moored.

The steamer in the lock did not lie against either wall, but in the middle of the lock, with her stem 50-ft. short of the inner lock gate. Her engines were ordered slow ahead and so kept for two minutes. The *Trilby*, about this time, was observed to be surging forward; in the result, the stem of the barge was struck by the projecting rubber band on the starboard side aft of the *Princess Astrid* and a good deal of consequential damage was caused. At the time of the impact the *Trilby's* stem was probably two or three feet to the southward of the line of the north wall of the lock. She had probably advanced something in the neighbourhood of 10-ft.

With no counterclaim, the onus was on the plantiffs to prove negligence in the defendant. It was said the *Trilby* had lain in this position, with similar moorings, often before. His lordship found that the *Princess Astrid* advanced at a rate of not more than four knots, and left the lock with her starboard side within a few feet of the northern wall.

He could not find her negligent in leaving it in this way. The reason why the *Trilby* came forward was that her moorings surged —the two breast moorings forward and aft and the after mooring which led substantially astern. He gathered that as the *Princess Astrid* cleared the head of the *Trilby* the forward mooring parted. His lordship thought this occurred as a result of the impact of the collision. But the reason the *Trilby* came forward was because her moorings surged.

The barge was noticed to be coming ahead when just abaft the bridge of the *Princess Astrid*; thereafter some 200-ft. of the *Princess Astrid* passed before the stem of the barge came in contact with the rubber band. If the *Princess Astrid* was moving at four knots, then from the time the barge was seen to have left her place to the collision was half-a-minute, and if the barge advanced 10-ft. it would look as though her rate of advance was a fifth of a knot.

If the barge was so moored with three moorings that they all surged because a spread of water in which she was lying advanced at the rate of a fifth of a knot, and her moorings were unable to resist that type of movement, the Court concluded that the barge could not have been properly moored. Barges were habitually moored in tideways where they had to resist water passing at a greater speed than that.

His lordship felt it quite impossible to say that the barge was properly moored. He had consulted the Elder Brother of Trinity House, who was sitting with him in the case, and he put the matter even higher. He said the moorings of barges or other vessels properly moored did not surge.

If one found the moorings of a vessel surging, that went a long way towards establishing that the craft was not properly moored. If a barge was to be moored 10-ft. from a lock entrance she should be so moored that, subject to such a small suction as the court found in this case, she would resist it—or that she was not properly moored.

His lordship had not to decide whether the plaintffs were negligent, but only whether they had established negligence against the defendant, and he was quite clear that they had not established any negligence at all. The *Princess Astrid* was entitled to go whichever side of the lock entrance she liked. His lordship thought she was entitled to assume that any sailing barge was moored near the entrance would be properly moored and in such a fashion that, unless subject to some quite unusual outside influence, she would remain in the position in which she had been placed, and seen.

He dismissed the claim, with costs.

2—Infraction of Navigation Act at Australian Port

(FROM A CORRESPONDENT)

A curious harbour point has been raised at the port of Townsville, Queensland.

Captain William Gardiner, master of a steamship, pleaded guilty to two charges of disobeying the Navigation Act: that in September he entered the harbour contrary to the quarantine regulations, that he had not been granted pratique, and further, that he failed to keep a quarantine signal displayed.

The solicitor prosecuting for the Navigation Department, said that the steamer in question had come from Hollandia, Dutch New Guinea, and, coming from those parts, it was necessary that the master of such vessels should not enter port without pratique.

When the quarantine medical officer went to the outer anchorage to inspect another vessel, Captain Gardiner's ship was not displaying a quarantine flag, and without obtaining pratique, Gardiner's ship, in charge of a pilot, entered the harbour.

Captain Gardiner, in his defence, said that Hollandia was at present occupied by the British and American forces and, as he had quarantine exemption from British ports, he thought he was quite in order in entering the harbour without a quarantine inspection.

Contending that Hollandia was still a Dutch possession, the Magistrate imposed a fine of £5, with £2 2s. 0d. professional costs on each case, in default one month.

Maritime circles are of the opinion that the whole case rested on the word " possession," and that expert advice should have been obtained before the fine was imposed.

Port of New York Development

Impressive Programme of New Works

At the annual Convention of the American Association of Port Authorities held at New York in October, Mr. Frank C. Ferguson, Chairman of the Port of New York Authority, announced a programme of port improvements estimated to cost 15 million dollars, to be undertaken immediately on the conclusion of the war.

Mr. Ferguson predicted that on the basis of Government estimates U.S. foreign trade might amount to $13,000,000,000 in 1948, or a third more than the previous peace-time high mark of 1929. He said the New York-New Jersey port area might handle $6,000,000,000 worth of foreign trade in 1948. He also predicted that the development of air transportation would not be detrimental to the welfare of such ports as New York, and stated that the proposed routes for post-war air transportation to and from New York included direct routes to Latin America, the North-West Coast of the U.S., the Far Pacific, Europe, North America and Middle Eastern ports.

The Execution of Port Works

Machinery and Plant in Connection with Civil Engineering Construction*

By Sir GEORGE MOWLEM BURT, M.Inst.C.E.

Dock, Harbour, and Similar Works

WORK comprised under this heading is perhaps the most interesting of all Civil engineering, because so many varied classes of construction are encountered in dock, harbour, and canal engineering. It is safe to say that every type of plant used for constructional purposes is made use of in connection with such projects; but as the machinery and plant used on engineering works generally is dealt with in other parts of the Paper, this section will be confined to plant which is used principally in connection with dock and harbour works.

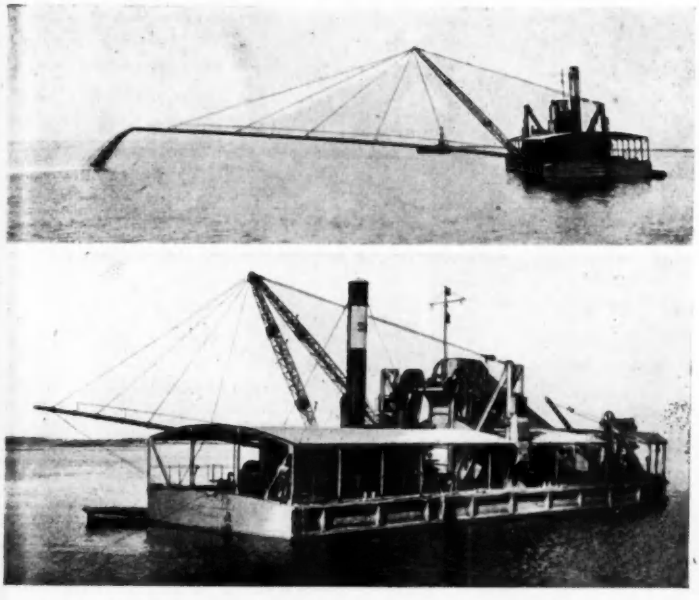


Fig. 1. Non-Propelling Bucket Dredgers with pump discharge. Dredging depth 26-ft. Length of discharge pipe, 165-ft.

Excavating Plant

All types of excavators are, and have been, used on the excavation of dock basins, canals, etc. Dredging plant can be considered under the four principal classes, namely: bucket ladder dredgers; grab dredgers; dipper dredgers; and suction dredgers.

The bucket dredger is the most common type of dredger used in Great Britain, and also generally throughout the world. This dredger, and also other types, were fully described in Sir Henry Japp's Lecture,* and the Author cannot usefully add to the general details tbout these vessels, except to draw attention to his own experience in dredging tough material with bucket dredgers, where it was found that the belt-driven dredger was the most satisfactory tool to use, for the reason that the friction clutch on the geared dredger is usually screwed up so tight that it will not prevent overloading of the gearing and shafting, and although the gear-driven dredger will take bigger loads of the hard material while it works, it is much more subject to breakdown of its transmission, whereas the belt-driven dredger continues dredging with the belt slipping whenever necessary, so that fewer breakdowns occur and a higher average output is obtained.

It may be of interest to draw attention to the modern tendency to employ a vessel capable of carrying out two operations, such as dredging by bucket dredger into hopper barges lying alongside, or dredging the soil direct to a pump which discharges it through a suspended pipe on to the shore for reclamation purposes.

Another and more simple type of dredger for the same two purposes is the dredger which dredges into hoppers alongside, or by means of a long shoot which can be used for reclamation purposes directly. When the dredger is being used as a long chute dredger depositing ashore, it is usually fitted with a pump discharging additional water into the shoot to carry the dredged material along it. Examples of these types of dredgers are the " Dr. Oliveira Salazar " and the " Engenheiro Poole Da Costa " (Fig. 1), owned by the Portuguese Government, which have buckets of 5½ cubic feet capacity, giving a nominal output of 220 cubic yards per hour. When being used for discharge ashore, the point of discharge is 165 feet from the centre of the dredger and 16 feet above water-level. An example of the long-chute dredger is a vessel of similar capacity to the two named above; when used in this manner the long chutes discharge at points 82 feet from the centre of the dredger to a height of 14 feet 9 inches above water-level.

Another dual-purpose dredger in use is a craft comprising rock breaking equipment as well as a dipper dredger; and the benefit of such a craft for some operations is obvious.

The removal of under-water rocks has also been fully described by Sir Henry Japp, but the Author would like to mention that for a small job a very efficient rock-breaker can be made out of the ordinary pile barge. The pile frame is mounted on the stern of the barge, and the winch, instead of lifting a monkey for driving piles, operates a long chisel which can be fitted with a single renewable point, or several renewable points, depending on the nature of the rock to be broken. This type of rock breaker was used with considerable success on the masonry invert of a lock at the Surrey Commercial Docks, where the material to be broken was mostly brickwork.

Under-water work is undertaken principally by divers, although for excavating and trimming the sea-bed the diving bell is more suitable. The diver's equipment is too well known to need detailed description here.

In the past, a diver was usually supplied with air from a hand-driven pump, capable of supplying air for either one or two divers; but to-day, where diving is undertaken regularly it is very common for the supply of air to be provided by a mechanically-driven air-compressor. Messrs. Siebe, Gorman & Co., Ltd., are the main suppliers of diving gear and equipment, and they provide all types of hand pumps and power pumps for supplying air to the divers, together with all the equipment necessary.

When the diver requires compressed air for working pneumatic drills, hammers, or rock breakers, it is common practice to have a single compressor, say a four-cylinder compressor on which three cylinders are for supplying high-pressure air for working the pneumatic tools, whilst the fourth cylinder supplies low-pressure air for the diver. If air from a compressor is used for the diver, a receiver should be used to provide a reservoir of air in case of temporary breakdown of the compressor. It is usual to insert a filter in the diver's pipe-line to extract any oil which may be present in the compressed air. As the diver usually has to work more or less in darkness, many varieties of submarine electric lamps are now provided for his use, as well as submarine hand electric torches and lamps.

It is frequently necessary for steel and ironwork to be cut under water. In the old days this was done either by sawing with a hack-saw or drilling with a hand-drill, but now the diver can burn the steel with the oxy-acetylene burner or cut with a

*Excerpt from Paper read before the Institution of Civil Engineers on 14th March, 1944, and reprinted by permission.

*" Modern Methods and Plant for Excavation," delivered to Students of the Institution in 1934.

The Execution of Port Works—continued

pneumatic saw or drill. If under-water burning has to be done at a depth of more than 30 feet, it is necessary to use the oxy-hydrogen burning gear, as it is impracticable to supply acetylene at the necessary pressure for deep-water work. In under-water cutting of steel, besides the oxygen and acetylene, or oxygen and hydrogen gas, it is essential to have a further supply of gas which is either compressed air or oxygen, the purpose of which is to form a hood in which the heating and cutting nozzles can operate. A separate tube carries the air or oxygen to this outer nozzle, which takes the form of an annular orifice surrounding the cutting flame, so that a water-free zone is provided in which the torch can continue to burn when it is taken under water. The best known under-water cutter in Great Britain is that used and supplied by Under Water Cutters, Ltd. (Fig. 2).

Experiments have been carried out lately in Great Britain, America, and other countries with submarine welding; this is a very recent development of electric welding, and Under Water Welders and Repairers, Ltd., have recently developed a very fine welding system whereby it is simpler to weld under water than in the air. This has now advanced beyond the experimental stage, and actual work is being carried out with electric welding. Recently the Author had the privilege of viewing a demonstration of under-water welding by a diver who demonstrated the use of his welding gear in making:

(1) a horizontal weld.
(2) a vertical weld working downwards.
(3) a vertical weld working upwards.
(4) an overhead horizontal weld.

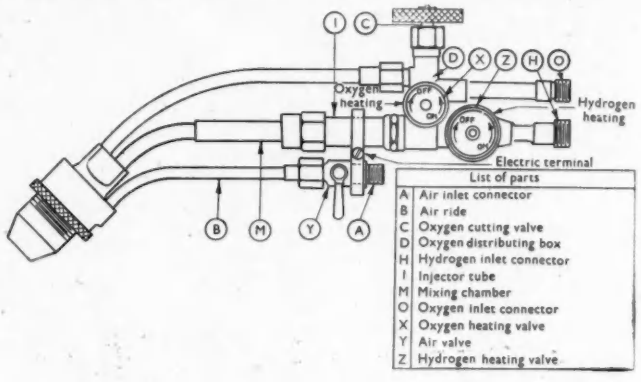
When the plates were brought to the surface, the welding was found to have, if anything, a neater appearance than most welding done in the air. Samples of welding made into test-pieces and tested were also on view, and the results of the tests showed that this welding under water was just as sound as welding above water. The actual results obtained were a breaking strength of 28.6 tons per square inch, with an elongation of 20 per cent. on a length of 2 inches, which compares very favourably with most welding. Various specimens tested had broken through the steel and not through the weld.

Although the diver can excavate and trim the sea-bed when this is necessary on a large scale, as in the construction of block-work breakwaters, it is found quicker and cheaper to use the diving bell for work of this class. Diving bells of various sizes have been used from time to time, the size being determined by the lifting capacity of the crane which has to handle the bell. The diving bell generally consists of a rectangular steel box, high enough to allow the workmen inside to stand upright; air is supplied by compressors, through hoses, and is allowed to escape under the lip of the bell. Light is supplied by electric lamps, and platforms and seats around the bell are provided for the workmen while it is being raised or lowered under water. Large steel diving bells were used to a great extent by Messrs. S. Pearson & Sons, Ltd., on the harbour works at Dover. These bells measured 17 feet by 10 feet 6 inches wide by 6 feet 6 inches high inside, and were fitted with air-valves, lenses, electric lamps, signalling gear, and loud-speaking telephones for communication between the men in the bell and the crane and compressor gear on the surface. The bells were handled by 40-ton "Goliath" cranes. A full description was given by Mr. M. F. Wilson, M.Inst.C.E., in his Paper on "Admiralty Harbour, Dover,"* 1919.

Where diving bells are employed for deep-water work, it is essential that decompression chambers should be available for any men suffering from compressed-air illness ("bends"). A decompression chamber is merely a cylinder box containing compressed air in which the patient can be placed; while the pressure is decreased gradually.

Pumps for Harbour and Dock Construction

The electric centrifugal pump is now the pump most generally used for constructional purposes in this class of work. The vertical sinking pump is very suitable, as it can be easily raised and lowered to suit tidal conditions. Vertical sinking pumps are made in sizes ranging from 2 inches up to 14 inches by various makers, the motor being mounted directly above the pump, but coupled directly to the impeller, which works in a horizontal plane. Some pumps are fitted with a bell over the motor so that the pump and motor can be lowered under the surface of the water, the bell preventing the water reaching the motor (Fig. 3). In the completely submersible type the pump and motor are contained in a water-tight case and can be lowered to sit on the bottom of the harbour or sea bed; these pumps will work for up to 1,000 hours without



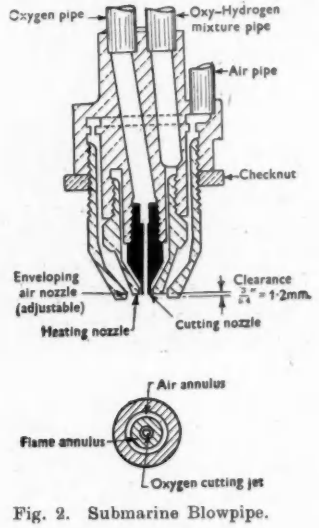


Fig. 2. Submarine Blowpipe.

attention of any kind, and they are completely ousting the old-fashioned steam pump, whether of the centrifugal, pulsometer, or piston type. Even when electricity is not available, engineers now prefer to use this type of pump, and to generate electricity by means of diesel-engine generators.

For the construction of dock basins, etc., in the dry, and where the subsoil is suitable, it is now quite common practice to make use of ground-water-lowering systems for keeping the site clear of water. These systems consist of sinking a series of wells all round the site of the operations, and pumping them out, thus draining and tapping the water in the ground before it reaches the actual constructional work. There are two classes of ground-water lowering, namely the "shallow well" system, and the "deep well" system. The shallow wells can operate only to a depth of approximately 24 feet, but if it is necessary to go lower, a series of shallow wells sunk in a series of terraces can de-water the ground to considerable depths. Where the shallow well system is in use it is not necessary to have a pump for each well, as one pump can pump from a dozen or more wells at the same time; but with the deep water system, a pump is required in each well.

* Min. Proc. Inst. C.E., vol. ccix (1919-20, Part I), p. 31.

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Generally speaking, the deep well system is more suitable for dealing with artesian water, and relieving water-pressure under the foundations of the work to be constructed, rather than for dealing with an actual inflow of water.

If a supply of compressed air is available, as is usually the case on modern constructional work of any size, the simple air-lift pump is advantageous, particularly for under-water work, for cleaning silt out of pockets before undertaking diving work, or before placing concrete on the sea-bed under water. This pump is a simple arrangement, comprising a steel or iron pipe capable

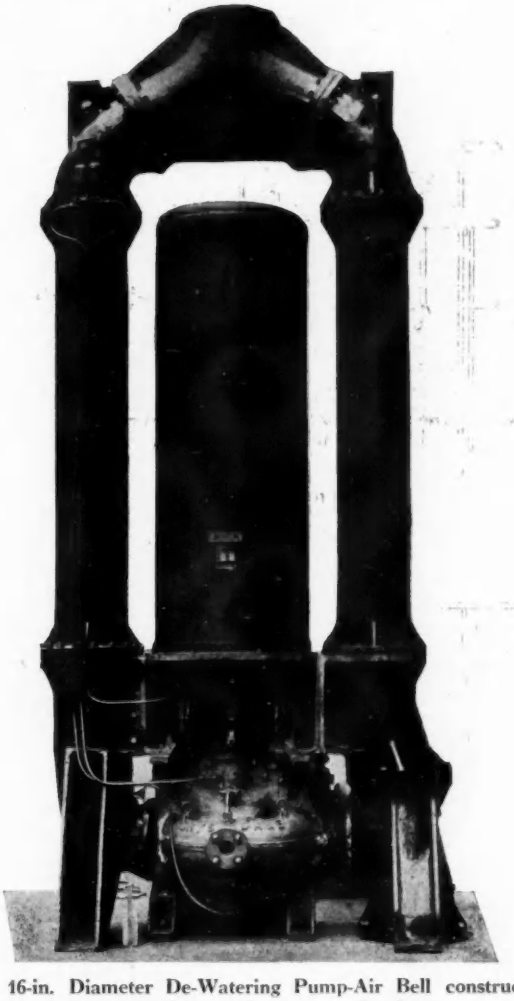


Fig. 3. 16-in. Diameter De-Watering Pump-Air Bell construction to prevent damage due to over-flooding.

of reaching the bottom, forming a suction pipe with a bend—usually a right-angle bend—and a delivery pipe to throw the water and/or silt away from the area being cleaned (Fig. 4). At the bottom of the suction-pipe is a connection for an air-pipe; this air-pipe is coupled to the compressor and the air rushing into the vertical sucton pipe of the air-lift carries the water and silt up it and discharges them at the end of the discharge. As there are no moving parts in this pump, it is very simple to handle and drop into the water at any point, and where divers are employed it is very useful in cleaning the bottom for them; but it is serviceable only when pumping a foot or two above the surface of the water, and will not pump efficiently against a high head.

Concreting Plant

Dock, harbour, and similar works generally call for mass concrete construction work, and mixers and mixing plant on this type of construction are usually, of large capacity, the 1 cubic-yard and the 2 cubic-yard sizes being the most common. As these mixers are so large, it is essential to have some mechanical means of feeding them in order to get the utmost benefit from their output, and this is attained by operating them in conjunction with a batching plant consisting of large hoppers to hold the aggregate, a fixed measuring hopper on the mixer, and generally a weighing machine for the cement which is frequently delivered to the side in bulk.

A good example of this type of plant is the washing, batching, and mixing plant used on the King George V graving dock at Southampton. This plant was designed and specially built for the job. Two 32-cubic-foot mixers discharged the concrete into a reception hopper with a capacity of about 10 cubic yards. The mixers could each turn out 1 cubic yard of concrete every 70 seconds, and the output from this plant was 1,000 cubic yards per shift. The material used was ballast dug from the site of the graving dock, which was then run and tipped into large reception hoppers, from which it was fed by two belt conveyors to twin washing plants: thence it passed through the washer and dropped into a collecting hopper above the mixers, from which it was fed into the measuring hopper of the mixers as required. The cement

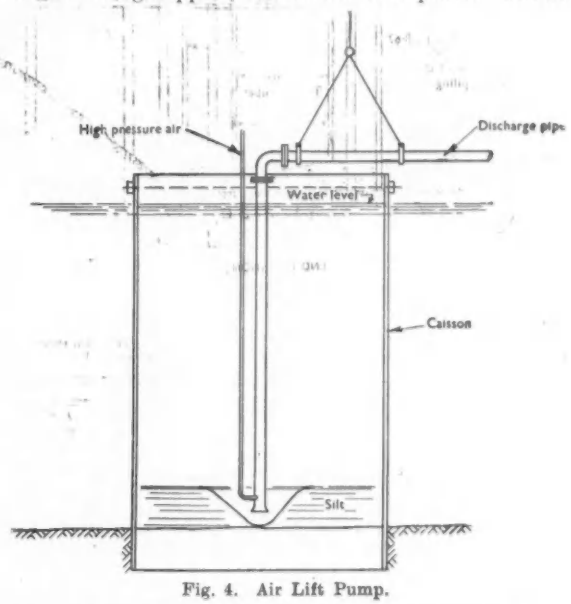


Fig. 4. Air Lift Pump.

was delivered in bulk in railway wagons into a cement shed, where it was unloaded into large storage bins, each equipped with a valve giving access to a worm conveyor which conveyed the cement to the boot of a bucket elevator for delivery into a hopper holding about 3 tons of cement. This hopper had two valves which fed into two weighing-machines, one above each mixer, where the cement was weighed and added to the ballast already in the measuring hopper of the mixer. The concrete was run from the mixer in 1½-cubic-yard bottom-dump skips carried on 4-foot 8½-inch gauge flat-bottomed trucks drawn by steam locomotives, and the skips of concrete were handled at the site of deposition by 5-ton and 7-ton locomotive cranes.

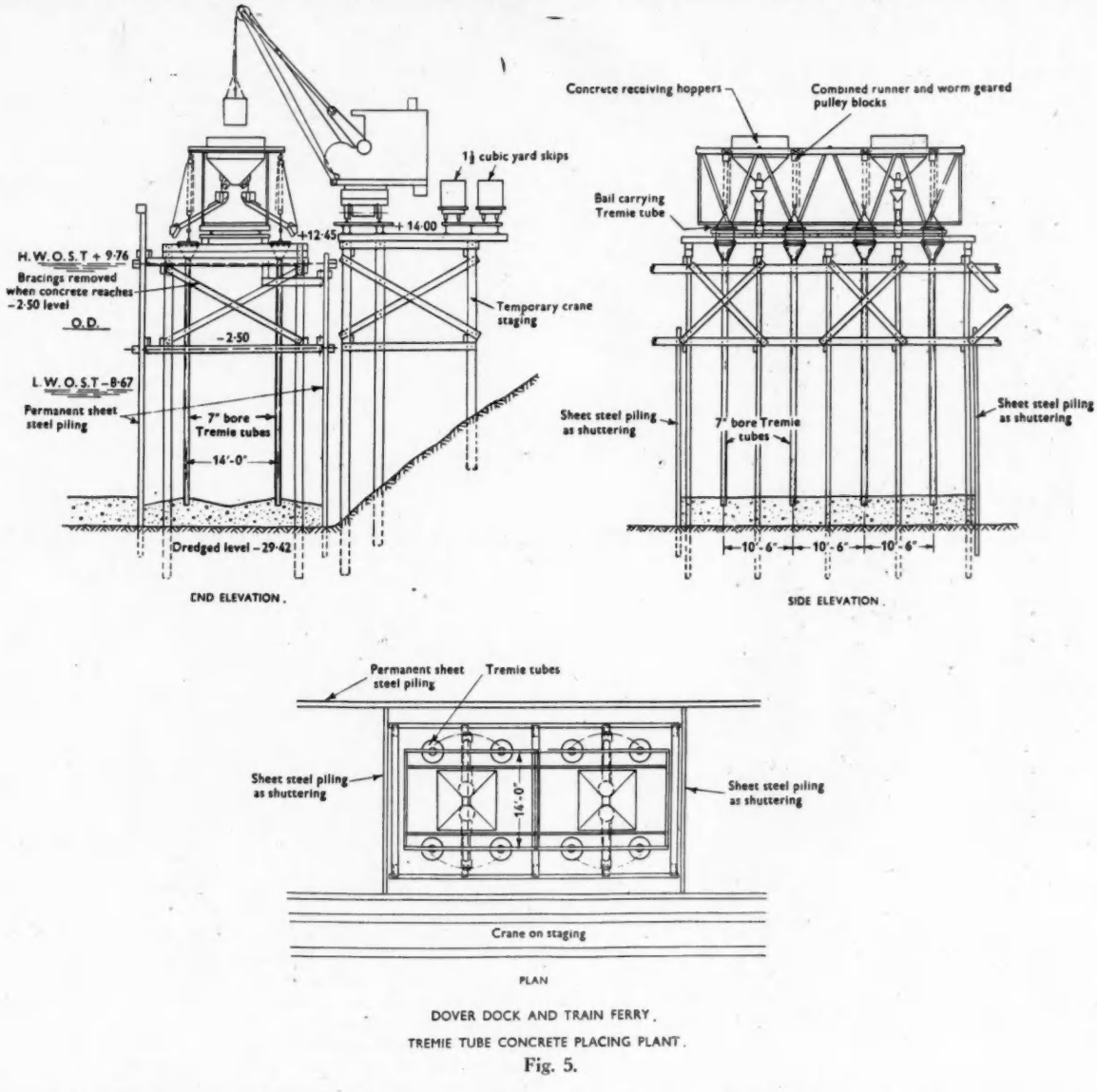
On large dock works it is usually standard practice to use a central mixing type of plant as described above, although the methods of distribution vary considerably, depending on the nature of the work and various other factors. Concrete pumps are being used to a great extent for this purpose, particularly in America.

In selecting concrete pumps as a means of distributing concrete, it is essential that the mix and the aggregate used be suitable for concrete pumps. Any wet concrete is naturally of an abrasive nature, and considerable wear is occasioned in the pump valves where the aggregate—particularly the fine aggregate—is of very hard and sharp material such as sand composed of flint particles. The rate of wear on the valves is then so excessive that it becomes completely uneconomic to use pumps for distributing the concrete. For instance, on the Dover Train-Ferry dock it was planned to

The Execution of Port Works—continued

use concrete pumps for distributing the concrete to be deposited in the dock walls. New pumps were obtained for the contract and put to work; but unfortunately the only aggregate available at an economic price was of an extremely abrasive nature, and it was found that the cost of new liners and new valves for the pumps

raised and lowered quickly as the concrete is poured; it must have a reception hopper at the top to allow concrete to be poured into it quickly; and above there should be a storage hopper holding a cubic yard or two of concrete for each tremie pipe in use. After the plant has been completely rigged up and the top hopper



DOVER DOCK AND TRAIN FERRY.
TREMIE TUBE CONCRETE PLACING PLANT.
Fig. 5.

was more than two shillings were cubic yard of concrete. That was the cost of the replacement of spare parts alone, without taking into account the labour cost in renewing the valves and liners. In one case, a pump with a complete new lining and valve worked for only 18 hours before it had to be entirely renewed.

Depositing Concrete under Water

For the deposition of mass concrete under water, it was formerly usual to employ bottom-dump skips, opened either by divers working on the concrete, or by double line cranes which handled the skips and released the doors. For many years various attempts have been made to deposit concrete under water by pouring it through pipes, but this never proved successful until the system of the "tremie pipe" was adopted. Now, tremie pipe concrete has proved itself to be equal in quality to concrete deposited by any other means under water. It is essential to have a well designed plant, possessing the following features: the tremie pipe must reach right to the bottom and must be capable of being charged with concrete, a plug is inserted in the tremie pipe, with a fit tight enough to ensure that it will not move easily down the pipe. The latter, resting on the bottom, is then charged with concrete, which flows from the storage hopper into the reception hopper and down the tremie pipe, pushing the plug in front of it; this process in continued until the tremie pipe is completely full of concrete, the water having been pushed out of it at the bottom by the weight of the concrete acting on the plug. It is then raised off the bottom an inch or two until the plug is pushed out of the pipe, and the concrete begins to flow on to the bottom, while fresh concrete is added at the top. Immediately the concrete shows signs of running too quickly through the tremie pipe, the tremie pipe must be lowered quickly on to the bottom and into the concrete already flowing out of it, which then acts as a valve and gradually stops the flow; the pipe can then be raised slightly until the flow re-commences. Once the art is learned, the operator, by manipulating the level of the tremie pipe, can maintain an even flow of concrete. The concrete flows slowly out of the bottom of

The Execution of Port Works—continued

the pipe in a sort of mushroom effect, and spreads slowly over the area to be concreted. The tremie pipe cannot be moved from place to place during concreting, and it is therefore necessary to have a series of such pipes so that the concrete flowing from one intermingles with that flowing from another, without having to travel too far. Once pouring concrete by tremie pipe has been started, the operation should be continuous until the pour is completely finished, as it has been found in practice that if operation ceases, and the concrete sets, a considerable amount of diver's work has to be done on the top of the concrete to clean off the laitance. Many engineers have been very sceptical as to the soundness of the tremie pipe concrete, but from the Author's experience of all classes of concrete placed under water, he has no hesitation in saying that properly poured tremie concrete is better than any other.

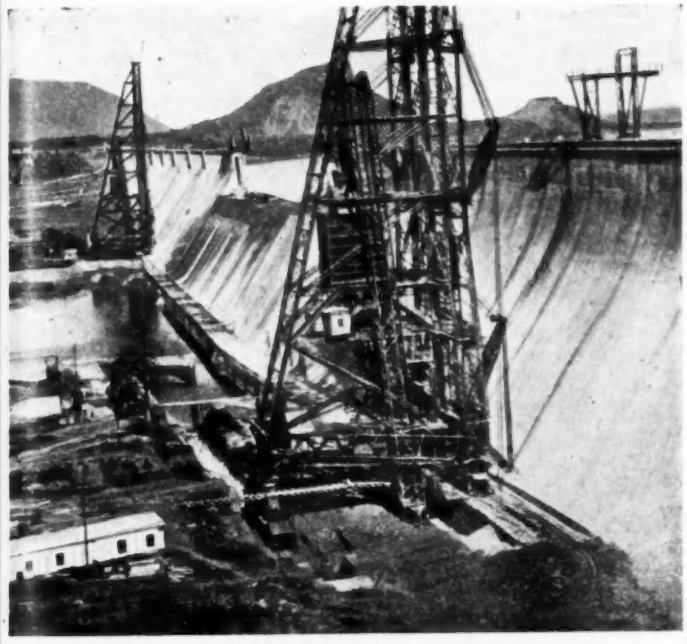


Fig. 6. Concreting Tower.

In 1934 all the side walls of the Dover Train-Ferry dock were placed by tremie pipe. Since that date, several large dry docks for the American Navy Department have been constructed in America by this means. The development of the tremie pipe for depositing concrete under water is having a tendency to reverse what was generally the practice in constructing dry and wet docks. Previous to the proven use of the tremie pipe, it was customary, in considering any dock project, to adopt a scheme for the construction of the work in the dry. Now, even when it is a simple matter to construct the dock in the dry, it is being found more economical to construct in the wet by carrying out all the excavation work by dredgers, at considerably lower cost than by any other method of excavation. After the basin for the dock has been formed in the wet, the walls and floors are now constructed by forming permanent steel shutters, usually of steel sheet-piles, and pouring the concrete by tremie pipe (Fig. 5).

Most large schemes of dock and dam construction require a concreting plant to be specially designed for the job. This does not mean that the mixers, etc., can be used only for that job, but generally speaking, considerable alterations have to be made in the structure to accomodate such a plant for a job other than that for which it was designed. An example of a specially designed concreting plant which was of use only for the particular job for which it was designed is the concreting tower designed and used on the Gauvery-Mettur reservoir project, South India (Fig. 6). The width of the work to be concreted exceeded 100 feet, and it was more than 150 feet high, all in mass concrete. The bed of the river was subject to sudden floods, and the towers had to be made mobile so that they could be taken out of the river-bed in the case of flood. Very large quantities of concrete had to be handled, and the towers were designed to deposit 2,000 tons per 12-hour day. The aggregate and cement were run into the towers, where the concrete was mixed, hoisted, and delivered through chutes to the work over a range of 125 feet of the dam without moving the towers.

(*To be continued*)

The River Severn

Its Post-War Navigation Facilities

At a luncheon given by the River Severn Commissioners at Worcester recently a programme of post-war river improvement was discussed, including the deepening of the river at a number of shallow reaches, the enlargement of six locks, and the reconstruction, or alteration, of seven bridges.

In introducing the subject, Mr. J. W. Healing, chairman of the Severn Commissioners, said that the Severn was well used before the war; had done a good job during the war and ought to take a much greater tonnage of goods. It could be made a strong link between the Midlands and the Continent of Europe and with the Bristol Channel and other British ports it did, in fact, bring the sea to the doorway of the Midlands.

Mr. Healing added that the Commissioners considered that the navigation as far as Worcester, 27 miles from Birmingham, should be enlarged so that short sea trading vessels and coasters of some 600 tons carrying capacity, and specially built craft up to 800 tons capacity, could navigate the river at all states of the tide. Between Worcester and Stourport, 20 miles from Wolverhampton, vessels of 300 tons carrying capacity should be able to navigate. They suggested that the Staffordshire and Worcestershire Canal should be redesigned to carry 100-ton barges as far as the junction with the Shropshire Union Canal, which was also the subject of an improvement scheme. This would link the navigation right through to the Mersey and Liverpool.

This scheme would allow ships capable of trading with the Continent to dock in the closest proximity to the Midlands for loading and unloading, and, with the larger type of barge trading to Stourport, would also improve the existing communications with ports in the Bristol Channel available for Midland shipments. With the construction of a dock basin at Diglis, Worcester, increased wharves and jetties at Stourport, modern handling installations, transit sheds and road and rail communications at both places, a " factory to ship " service would be provided.

At the same time as locks were being enlarged, improved weirs with sluices to control water levels and assist land drainage would also be included. The Severn was at present navigable by 300-ton vessels as far as Worcester, and by 150-ton vessels between Worcester and Stourport.

Developments at the Port of Dublin.

An official visit by Alderman M. O'Sullivan, Lord Mayor of Dublin, has been made to the improvement works at the port recently completed or actually in hand. Among the places inspected was the reconstruction work at the Custom House Quay. There, among other facilities, a berth with a depth of 16-ft. at low water is being provided for vessels engaged in the Continental and coasting trade, and for some of the vessels carrying general cargo from America. New shed accommodation will also be provided at the north wall extension.

An inspection was made of the transit sheds in connection with which the regulations for the more expeditious control of goods brought into operation on November 1st. It is hoped that the former congestion will be avoided under this scheme. The sites for proposed new transit sheds, warehouses and oil refinery were also visited.

Mersey Dock Board

Programme of Future Works

In an address to members of the Mersey Docks and Harbour Board on December 14th, the chairman, **Sir Thomas A. L. Brocklebank,** made an important announcement in reference to the programme of new works to be undertaken by the Board in the near future. The following is a report of his speech.

When I spoke to you a year ago, I outlined a programme of modernisation of the existing docks which I thought would make us up-to-date and would certainly employ all the labour, material and finance likely to be available for two or three years after the cessation of hostilities. Nothing has occurred meanwhile to cause me to doubt the soundness of those plans and as you know we are now promoting a Bill in Parliament designed to enable us to put that programme into effect as circumstances permit—but I must warn the Board that I now have reason to expect that demands for labour for housing, etc., will be given priority over us so that my forecast of three years must now be modified to five or more.

Pension Scheme

Included in the Parliamentary Bill is a clause enabling us to inaugurate a Contributory Pension Scheme for the staff. Personally, I should welcome such a project, with rules drawn up jointly by representatives of the staff and the Board, jointly appointed Trustees to administer it, and the bulk if not all the capital money of the fund invested in Government stocks or other Trustee Securities. But before such a scheme can be put into effect, much actuarial investigation is necessary while we must take into account the possible repercussions of the " National Security " legislation shortly to come before Parliament. I must make it quite clear, therefore, that all we are asking for in the present Bill, is Power to establish such a fund as and when we are satisfied that it is in the best interests of all concerned to take such a step.

Dockers' Canteens

During the year, we have completed the Canteen programme and now have efficient and comfortable canteens available for workers all over the Dock Estate. We have also made considerable progress with the provision of medical centres. Of these, the Huskinsson and Gladstone centres have been tackling new cases at the rate of nearly 5,000 a year each, showing clearly that they are doing really good work for the Dockers and others employed in the Port.

Dry Docks

It is my intention very soon to ask the Committees concerned to turn their attention to the modernisation and improvement of our Dry Docks. I have felt for some time that, while adequate in size and general lay-out, our Dry Docks were rather lacking in those specialised facilities which shipowners are coming to expect and which certainly influence them in deciding where to dock their ships for major under-water repairs. On a recent visit to the United States, I was much impressed with the obvious trouble taken in their more modern Dry Docks to make things as easy as possible for the ships using them—the provision of electric light and power, water, steam, compressed air, and perhaps, most important, up-to-date sewage disposal plant are an enormous help to the ships and crews, and I think we should be wise to take prompt steps to bring our more important Dry Docks up-to-date in these respects.

Porterage

The question of Master Porterage is being examined by a special Sub-Committee and all interests concerned have been invited to express their views on any improvements or alterations which they consider should be made with a view to improving the efficiency of the Port. This is an important matter and we shall much appreciate the close co-operation of the Trading Associations and the Master Porters.

Having spoken at some length last year on what we planned to do in the future, I had hoped this year to have been able to tell you the details of some rather remarkable achievements of the recent past. Rather to my surprise, I am not allowed to do so on security grounds, so I must confine myself to generalities. As I told our American friends the other day when accepting the plaque they so kindly presented to us, I was rather horrified when I first heard the details of the projected import programme through this port prior to D-Day. That we dealt with it, with ease, was due to the most helpful co-operation of the 15th U. S. Army Port Group and to the really excellent work done by everyone working in the Port. Every man from top to bottom put his heart into the job, saw to it that there were no avoidable delays (and hardly any unavoidable ones) and the results, when they can safely be announced, will, I am sure, cause you to join with me in congratulating all concerned on the accomplishment of a first-class performance, efficiently and on time.

The Proposed New Works

The works alluded to abvoe in the chairman's address are set out in the following extract from the Parliamentary notice of the Bill to be presented in the ensuing session.

(A) A new entrance from the River Mersey into the Langton Dock with wing walls on each side of the inner end and on the west side of the river end of such entrance;

(B) A river wall extending from the southern end of the east wall of Work (A) to a point on the existing river wall approximately abreast of the southern end of the west quay of the Canada Dock:

(C) A river wall extending from the extremity of the west wing wall at the river end of Work (A) to a point on the existing river wall near the landward end of the North Jetty.

(D) A new cut or passage between the Brocklebank Dock and the Langton Dock together with wing walls on each side at both ends of the new cut or passage;

(E) An enlargement and alteration of the Canada Dock on its northern and

(F) western sides and of the Brocklebank Dock on its western side;

(G) A widening of the quay on the west side of the Langton Dock:

(H) A new quay wall extending from the Brocklebank Dock to the Langton Dock to the eastward of the existing cut or passage between those Docks.

In connection with and for the purposes of the new Works (i) to remove or fill up wholly or partly the West Langton Lock the East Langton Lock and the Canada Lock (ii) to remove the piers or jetties on either side of the entrance to the Canada Basin, known respectively as the North Jetty and the South Jetty, and the existing cut or passage between the Brockleband Dock and the Langton Dock and (iii) to fill up the existing west cut or passage between the Langton Dock and the Alexandra Dock.

The Board also seek powers to inclose and reclaim so much of the bed shore and foreshore of the River Mersey and the Canada Basin as will be situate on the east side of Works (A) and (B) or between Works (A) and (C).

Proposed Developments at Australian Port.

It is stated in the Australian Press that important developments at the Port of Portland, Victoria, are under consideration. Following investigations by the Public Works Department, Mr. D. Stevenson, the chief engineer, has reported that deep-sea shipping is served at Portland by a pier having a head 1,130-ft. long, 120-ft. wide, directed eastward, connected to the shore by an approach 2,070-ft. long, which for the greater portion of its length is 31-ft. wide. Each side of the head is served by a central goods shed 490-ft. long and three rail tracks connected to the Victorian rail system by a single track. The pier is lit by electricity. Depths of water available are from 25-ft. to 34-ft., the north side having not less than 32-ft. over the outer 600-ft. Unfortunately the port is not sufficiently protected from the south-east; otherwise the natural facilities for the harbouring of deep-sea vessels are excellent. It is spacious and there are good anchorages. Requirements, however, include slightly greater depth at the piers, the extsnsion of the piers, or a docks scheme.

Clyde Port Amalgamation

The subject of port amalgamation on the Clyde has been discussed by a number of interested authorities.

Glasgow Chamber of Commerce

The Glasgow Chamber of Commerce at a meeting held recently, agreed, subject to certain conditions, not to oppose the unification of the Clyde harbours. This followed an invitation given by the committee under Lord Cooper which is now considering the unification proposals, and is similar to invitations which have been made to other interested bodies, to offer their opinions as to future policy on the Clyde.

In reaching this decision, the Home Affairs Committee thought that the present administration had not interfered with the efficiency of the Glasgow Harbour, which represented 90 per cent. of the total dues and shipping interests of the estuary. But they decided that unification of the interests from the Albert Bridge to the Cumbraes should not be opposed if such unification permitted the adoption of an administrative body such as the Clyde Navigation Trust; that it would entail no additional burdens on shipowners, shippers or cargo receivers; and that it did not diminish the efficiency of operation. It was stipulated that Glasgow and the Clyde must not be put to a disadvantage owing to excessive expenditure as a result of unification, and it was also essential, the Chamber urged, that rates and charges should bear comparison with similar charges in other principal ports.

The committee also approved a decision that there should be an investigation into the possibility of adapting the upper reaches of the Clyde for barge transportation into the heart of Lanarkshire. (This is already the subject of an enquiry under the Scottish Council of Industry).

The position, as it at present operates, was detailed by Mr. Boyd, who said that the four interests now involved are the Clyde Navigation Trust (from Glasgow to Port Glasgow), the Greenock Harbour Board (Greenock Harbour only), the Clyde Lighthouse Trust, and the Clyde Pilotage Authority.

There was no criticism of the present authorities, but it appeared that the Government wished the Clyde to speak with one voice and it would not be wise to dispute that proposition.

Greenock Harbour Trust

Greenock Harbour Trustees have also endorsed the proposal for a single authority, provided that adequate safeguards are included in the new body's legislation ensuring that local interests are not overlooked.

This has been stated in a memorandum by the trustees sent to the Cooper Committee. The trustees further state that they are of opinion that the national interests, and those of the trade of the river and Firth of Clyde, " can best be served by amalgamation, under a unified control, of all the ports, harbours, piers, seadromes, navigational and anchorage facilities of the river and firth, and the lochs leading from them, and that such unification would eventually lead to the full development o fthe Clyde as a deep-sea and seaplane terminal port, as well as an important distributing commercial centre."

Clyde Navigation Trust

At a meeting of the Clyde Navigation Trust early in December, consideration was given to a draft memorandum by the General Purposes Committee, proposed to be forwarded to the Secretary of the Clyde Estuary Committee.

Moving approval of the General Purposes Committee's minute, Mr. William Cuthbert, chairman of the Trust, said the matter was one of very special importance to the Clyde Navigation Trustees, and since the appointment of Lord Cooper's Committee it had been receiving very careful consideration.

The submissions which they now proposed to make made it clear that, in the opinion of the Trustees, considerations of shipping and navigational services as a whole in the Clyde area would be facilitated and administration simplified by unification, excluding pilotage, provided Glasgow port interests were safeguarded, and that representation on any new authority was commensurate with the volume of Glasgow trade, which represented about 90 per cent. of the whole.

Review

Manual of Firemanship: A Survey of the Science of Firefighting. **Part 7. Fireboats and Ship Fires.** Pp. 149 with numerous diagrams and illustrations. Price, 2s. 6d. net., London, 1944. H.M. Stationery Office.

No reader of this Journal could fail to be aware of the emphasis which has always been placed in its columns on the subject of the avoidance, or the prompt extinguishment, of ship fires occurring at ports or within harbour waters. This, however, is only one phase of a matter of far-reaching importance, since fires may break out at sea and in circumstances of extreme remoteness from all organised and expert assistance. The manual under consideration is designed to cover these and all other widespread experiences.

It is an excellent publication, full of instructive directions and explanatory detail, illustrated by a great number of clear and readily intelligible diagrams. It should be in the hands of everybody who is responsible for shipping operations, either ashore or afloat, for, however fortunately situated as regards fire brigades and official help to deal with an outbreak of fire, unexpected contingencies may arise at any time demanding prompt and intelligent action.

The booklet contains a full and ample description of the appliances employed in firefighting and deals with the navigation and handling of fire boats, of which it is stated that before the war there were probably not more than half-a-dozen operated by the Fire Brigades and manned by trained firemen. These were incapable of putting to sea, and were used to cope with fires on ships at moorings and with waterside warehouse fires. Since then, on account of the prevalence of enemy bomb and torpedo attack, the number has been greatly increased

For readers engaged in port work, the more apposite and essential part of the publication is that concerned with the manœuvring into position and the operation of fire boats in the confined areas of river estuaries and docks. A good deal of the information is of an elementary character and the explanation of nautical terms may be deemed superfluous by expert mariners, but as the booklet is also intended for " land-lubbers," it cannot be considered out of place. The functions and capabilities of a fire boat are described under the different conditions obtaining at sea, in estuaries and tidal rivers, and in non-tidal waters.

Interesting Case of Dock Salvage.

A somewhat unusual incident in the course of dock dredging operations is reported in the following extract from a recent issue of the *London Evening News*.

" When the blitz struck London in September, 1940, there was a barge in St. Katherine's Dock, near Tower Bridge. It was loaded with bottles of wine. On the night of September 11th St. Katherine's Dock went up in flames—Goering had begun (as he believed) to wipe London from the map.

" The barge was sunk. The bottles of wine went to the bottom. The owners of the wine wrote it off as a total loss.

" The other day some dredger men at work in St. Katherine's Dock lowered a bucket, hoisted it up—and found it full of wine bottles.

" The owners did not want to be bothered with them. So the Port of London Authority took them.

" Now they have been auctioned off at one of the sales of drinks conducted by Messrs. W. and T. Restell, of Leadenhall Street, at Beaver Hall, in the City.

" The wine from the bottom of St. Katherine's Dock fetched £10 a dozen—just over 16s. a bottle. It consisted of 17 bottles of hock type, one 10 of Burgundy type, one each of Chablis and claret type, and seven half-bottles of sherry type.

" And I heard the Auctioneer say, as he put them up: " This lot will be sold with all faults—but I can assure you there is not to be any ullage."

" I had a look at the bottles. They did not seem to me to be any the worse for their submarine life."

Ullage, of course, is the difference between the total capacity of a cask and its actual contents.

Port of Launceston Facilities

The accessibility and facilities for shipping at the Port of Launceston, Tasmania, were recently under discussion between the Master Warden (Mr. Robinson, M.L.C.), of the port and members of the Executive Committee of the Local Chamber of Commerce.

Mr. Robinson said there had been criticism of shipping movements and conditions of the channel reaches leading to the Launceston wharves. He produced figures showing that over the past 18 years channel depths in the upper reaches had been improved, and at the present time, despite the dry season and absence of dredging plant, depths were being reasonably well maintained. The Board did not intend to relax its efforts to improve the upper reaches.

Referring to King's Wharf, the Master Warden said the new section in concrete would shortly be occupied by the inter-state steamer. Preparations would then be made for the reconstruction of the original portion, which would be a post-war project.

Lighting arrangements for night navigation of the river also had been considered recently, and were being improved. Wherever possible, electric lights were being installed.

Publications Received

From the United Steel Companies, Ltd., Sheffield, has been received a copy of a new and enlarged edition of their **Structural Engineers' Compendium.** It is a handbook of just over 900 pages, containing an immense amount of data and general information of great use to practising engineers and architects, especially at a time when post-war planning is calling for extensive constructional operations. Although primarily intended for the general practitioner, there are sections of the book which come within the particular scope of a dock engineer's requirements. As a war-time production, the book is remarkable for its attractive style and finish. Owing to the expense involved, the price of the book has been fixed at one guinea.

Research and Development in Aeronautics, by H. E. Wimperis, C.B., C.B.E., being the 31st Thomas Hawkesley Lecture to the Institution of Mechanical Engineers. Published by the Institution.

Drawing Office Practice in Relation to Interchangeable Components, by C. A. Gladman, B.Sc., being a Paper read at an Extra General Meeting of Institution of Mechanical Engineers. Published by the Institution.

The Construction and Launching of Submarine Pipe Lines, by J. D. Bird, M.Inst.C.E., being a Paper read before the North Western Association of the Institution of Civil Engineers, 17, Albert Square, Manchester, 2.

Silver Fox Stainless Steels and **Red Fox Heat-Resisting Steels** are two illustrated catalogues issued by the United Steel Companies, Ltd., containing information about experimental work on these materials.

Anuario des Serviços Hidraulicos, 1941. Ministerio des Obras Publicas e Comunicaçoes, Republica Portuguesa, Lisboa.

Gothenburg Harbour Development.

In connection with a programme of improvements at the Free Harbour, the Gothenburg Harbour Board has applied to the City Council for a grant of 450,000 kroner towards the cost of the following works: Basin No. II is to be dredged to a depth of 9.5 metres; the quay on the south side of the Basin, 140 metres in length, is to be lengthened by 380 metres and widened to 19 metres; three rail tracks are to be provided to connect with the Kville marshalling sidings; two goods sheds are to be erected on the quay which, later, will be equipped with 18 cranes. The whole of this work, which is intended to be carried out in three stages, is estimated to cost 15,400,000 kroner.

Other improvements contemplated, under an additional grant of 1,375,000 kroner, are a new warehouse and a Customs House. The new warehouse will be situated in the south-east part of the Free Harbour; it will be a single-storey building with a floor area of 2,500 sq. metres.